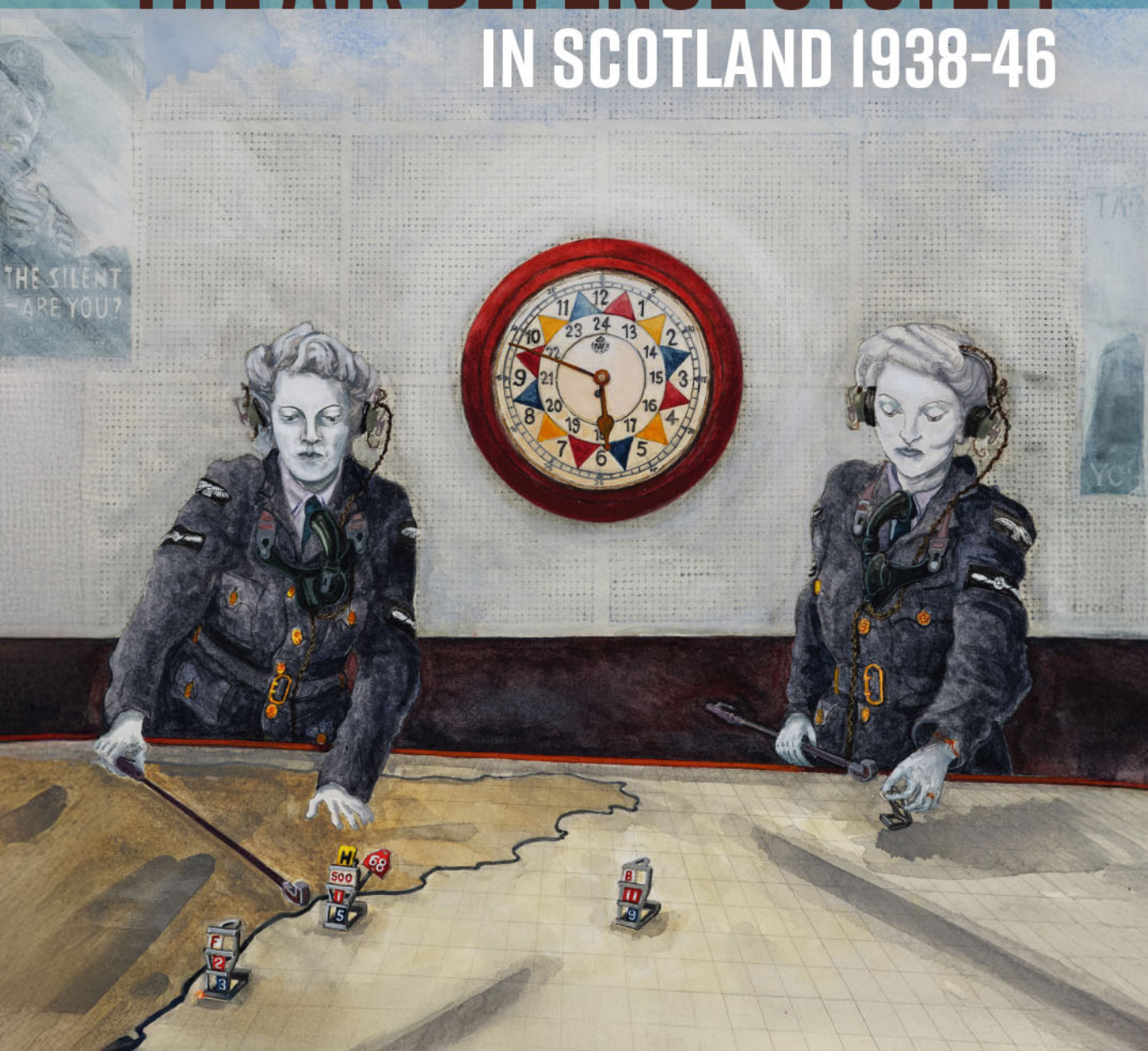
IAN BROWN

THE AIR DEFENCE SYSTEM
IN SCOTLAND 1938-46



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National Museums Scotland

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Contents

Illustrations *7*
Glossary *13*
Note about measurements *21*

Foreword 23
Acknowledgements 25

PART I **27**

Introduction **29**
Chapter 1 The Air Defence System in Scotland 1938-46 **33**
Chapter 2 Filtering and Plotting Aircraft **61**
Chapter 3 Movement Liaison Organisation and tracking friendly aircraft **73**
Chapter 4 Communications networks **89**

PART II **103**

Histories of the air defence centres covering Scotland 1938-46 **105**

PART III **251**

Tracking shipping **253**
Naval Plotting Rooms covering Scotland **255**

Archival sources *271*
Bibliography *283*
Index *287*

Illustrations

PART I

1. Bawdsey Filter Room table, photographed during the Home Defence Exercise in August 1938
2. Royal Air Force Fighter Command No 13 Group and Sectors, 3 September 1939
3. Royal Air Force Fighter Command No 13 Group and Sectors, December 1939
4. Royal Air Force Fighter Command No 13 Group and Sectors, June 1940
5. The air defence system in Scotland in March 1940
6. Royal Observer Corps Group areas and Group Centres, 1943 – 1945
7. Royal Air Force Fighter Command Nos 13 and 14 Groups and Sectors, May 1942
8. The air defence system in 13 Group in October 1942
9. The air defence system in 14 Group in October 1942
10. Royal Air Force Fighter Command No 13 Group and Sectors, July 1943
11. Royal Air Force Fighter Command No 13 Group and Sectors, June 1944
12. Royal Air Force Fighter Command No 13 Group and Sectors, April 1945
13. Gun Operations Rooms in Scotland during the Second World War
14. A still from the film *The Scope and Purpose of the Filter Room* showing the filter table with plotting counters, raid plaque and different coloured range arcs from radar stations
15. Another still from *The Scope and Purpose of the Filter Room*, showing filterers working on and across the filter table
16. The Temporary Filter Room at Stanmore, showing the time indicator at top left, with the number 3 illuminated
17. Chain Home radar station plotting counters
18. Chain Home Low radar station plotting counters
19. Strength of aircraft counters
20. Height counters

21. Filter arrows
22. Raid plaque, in this example for X462 (unidentified raid number 462) comprising four aircraft at an altitude of 17,000 feet
23. Halmas
24. Broad IFF and Normal IFF counters for CH radar stations
25. Broad IFF and Normal IFF counters for CHL radar stations
26. Drawing of a Raid Block, in this case for Hostile 686, comprising two aircraft at 18,000 feet, with one Flight from No 161 Squadron ordered to intercept
27. Sector Clock
28. Sector Clock, with 2½-minute rather than 5-minute sectors. These clocks were mainly used by the Royal Observer Corps
29. WAAFs LACW R Davie, LACW M Kidson and LACW Joan Wylie at the plotting table in Peterhead Sector Operations Room in 1944
30. Aerial view of Inverness MF D/F station, taken in October 1942
31. Plan of Leuchars MF D/F station
32. Inside Sumburgh MF D/F station
33. Typical HF D/F station
34. Drawing of the standard VHF D/F or Fixer Station tower
35. Cauldhame VHF Fixer station in Orkney, circa 1956
36. Mobile VHF Fixer station, on a Commer Q2 15cwt truck
37. Map of VHF D/F Fixer stations
38. Growth of the underground cable network in Scotland during the Second World War
39. Communication links between radar stations in the Western Isles and North-West Highlands, Sub-Filter Rooms and Inverness Filter Room at Headquarters No 14 Group, circa late 1942
40. T1154 W/T transmitter used at Eorodale CHL radar station for communications
41. R1084 W/T receiver used at Eorodale CHL radar station for communications
42. Layout of VHF R/T and D/F facilities in a typical Fighter Sector during the latter part of the Second World War
43. TR9D high frequency radio set
44. TR1143A VHF radio set

PART II

45. Aberdeen Observer Centre, Autumn 1939. George A Williamson, Controller, is standing at the left
46. George Williamson (Controller of No 38 Group) on left with Sir Windham Carmichael-Anstruther (Group Commandant of No 34 Group, Glasgow, from 1943-1944 and Group Commandant of No 38 Group from February 1945), taken in 1945

47. Ayr Centre personnel, taken outside the Centre in Nile Court. Observer Commander John Kennedy, Group Commandant from 1943 until 1945, is third from left in the middle row
48. Sub-Sector Operations Room at Benbecula
49. Temporary Filter Room at Stanmore (Bentley Priory), circa February 1940
50. Underground Filter Room at Stanmore (Bentley Priory) taken on 10 September 1945
51. Temporary Operations Room in Bentley Priory, 14 February 1940
52. Underground Operations Room at Bentley Priory
53. Aerial view of Aikenhead House, showing the GOR building built to the rear
54. 404 Gun Operations Room, photographed on 13 March 1945
55. 404 Gun Operations Room, photographed on 13 March 1945
56. Dundee Observer Centre in St Cuthbert's Hall, in December 1939
57. Dundee Observer Centre in St Cuthbert's Hall, in 1951
58. Supermarine Spitfire Mk V of No 603 Squadron in wintry conditions at Dyce on 4 February 1942
59. Aerial view of Forth GOR at Craigiehall
60. 403 Gun Operations Room, photographed on 13 March 1945
61. 403 Gun Operations Room, photographed on 13 March 1945
62. Forth Gun Operations Room Officers and NCOs, April 1945, Captain Cd'O Pilkington Jackson seated second from left
63. Galashiels Centre, circa 1939
64. Revised layout proposed in June 1938 for Nos 31, 34 and 36 Groups, Observer Corps, with the shading showing the area without telephonic facilities
65. Plotting map from No 34 Observer Group, showing the track of Hess' aircraft on 10 May 1941, confused at one point with a Boulton Paul Defiant attempting to intercept
66. Plan of proposed purpose-built Observer Centre
67. Raigmore on 9 May 1942, with the protected accommodation for the Fighter Group Headquarters still under construction. With reference to the site plan below, the Operations Block can be seen in the trees upper centre, the Filter Block in the trees upper right and the Signals Block in the trees bottom centre
68. Inverness (Raigmore) Fighter Group Headquarters site plan
69. Sketch of Inverness Filter Room by Joy Moore, as it looked in 1944 when she served there
70. Targe, awarded monthly between November 1941 and May 1944 to the best Post in No 39 Group
71. Plan of the ground floor of Kirkwall FSHQ, Sub-Filter Room and Gun Operations Room

72. Plan of the first floor of Kirkwall FSHQ, Sub-Filter Room and Gun Operations Room
73. Tote Board from Kirkwall FSHQ Operations Room
74. Scapa Gun Operations Room, housed within Kirkwall FSHQ, taken in June 1944
75. Boy's Hostel, Lerwick, used as Lerwick Fighter Sector Headquarters, Lerwick Sub-Filter Room and Shetland Gun Operations Room
76. Sketch of Shetland GOR in the ground floor of the Boys Hostel, Lerwick, 1941
77. No 13 Group Headquarters site plan dated June 1941
78. Drawings of the underground Operations Block
79. *Forget-Me-Nots for Fighters*, published in 1940, which contains useful advice for fighter pilots, including "never stop looking round. Many pilots shot down never saw the enemy fighter that got them" and "maintain R/T silence unless you have something important to say," using cartoon-style drawings by Aircraftman Hooper to illustrate each point
80. Jim Struthers in ROC uniform, with his wife Enid at Armaddy Castle
81. Women Observers outside Oban Centre (Back L-R: Eadie Parsons, Cathy MacCulloch, Fiona Tindall (Currie), Annie MacGregor. Front L-R: Morag MacIntyre (Campbell), Ishbel Little (MacCallum), Jean Campbell
82. Drawing of a typical Wireless Observation Unit post
83. LACW Joan Wylie (from Bridge of Weir), LACW Mabel Kidson (from Edinburgh) and LACW R Davie (from Aberdeen) at the plotting table in Peterhead SOR in 1944
84. LACW Aileen Wylie and LACW Joan Wylie (sisters from Bridge of Weir) at the plotting table in Peterhead SOR in 1944
85. Drawing of Portree Centre plotting table, as laid out in 1942
86. Personnel of Portree Centre with Scottish Area Commandant, Air Commodore R Peel Ross, photographed outside the Centre, circa 1942
87. Powbank Mill in 1941, from *A Yank in the RAF*
88. Sketch of Scapa GOR in 1940
89. Supermarine Spitfire Mk IIAs of No 123 Squadron (P7443 XE-K nearest the camera), based at Castletown but under Tain Sector control, probably taken in late 1941
90. Tain FSHQ Operations Block site plan
91. RAF Turnhouse, taken from the north, on 2 May 1940. The FSHQ is the protected building centre right, just behind the row of six huts
92. Supermarine Spitfire Mk Is of No 609 Squadron at Drem, but under Turnhouse Sector control, taken in February or March 1940
93. Plan of the Operations Block at Barnton Quarry, Air Ministry drawing number 5291/41, drawn in June 1987 and showing access to the underground building dating from 1952

94. Turnhouse FSHQ at Barnton Quarry, taken in 1948 when in use post-war by a Fighter Control Unit of the Royal Auxiliary Air Force
95. Pilots and Hawker Hurricane Mk I L1822 of No 111 Squadron at dispersal at Wick in April 1940 (with a Lockheed Hudson in the background)

PART III

96. Torry Battery, taken in 1947
97. Lerwick Naval Plotting Room, in Fort Charlotte, housed in the concrete structure in the centre right of the photo
98. Admiral Commanding Orkney and Shetland Offices at Head of the Right, Lyness
99. The Central Communication Building & Staff Office at Wee Fea, containing the Lyness Naval Plotting Room, photographed on 23 October 1945
100. Plans of both floors of Area Combined Headquarters, Pitreavie
101. Sectional views of Area Combined Headquarters, Pitreavie
102. Pitreavie Naval Plotting Room

Glossary

Admiral Commanding Orkney and Shetland (ACOS)
The senior Royal Navy officer in charge of naval units in the Orkney and Shetland area, including responsibility for the Home Fleet Base at Scapa Flow.

Air Defence of Great Britain (ADGB)
The Royal Air Force organisation responsible for the air defence of Britain from 1925 until 1936, when it was re-named Fighter Command, and from 1943 until 1944, when Fighter Command was re-named back to ADGB.

Air Officer Commanding-in-Chief (AOC-in-C)
The Royal Air Force officer of Air Rank (Air Commodore or above) in command of a unit.

Air Raid Warning (ARW)
Part of the air defence system, the National Air Raid Warning System was operated initially from HQFC and air raid warnings issued to one of 130 Warning Districts across Britain, with the exception of Orkney and Shetland, where air raid warnings were issued locally. This system was eventually devolved.

Anti-Aircraft Command (AA Command)
The British Army formation responsible for anti-aircraft guns.

Anti-Aircraft Defence Commander (AADC)
The Royal Artillery officer in a Gun Operations Room in operational command of the anti-aircraft guns within that Gun Defended Area.

Anti-Aircraft Operations Room (AAOR)
The location from where aircraft movement information is disseminated to anti-aircraft gun batteries and which is in operational command of all anti-aircraft

guns within that Gun Defended Area. Renamed from Gun Operations Room (GOR) in late 1942.

Auxiliary Territorial Service (ATS)
The women's branch of the British Army.

Bawdsey Research Station
Located in Suffolk, the establishment developing radar equipment primarily for the Royal Air Force.

Chain Home (CH)
The principal long-range early warning radar used in the UK between 1936 and 1958. See pp 28-36 of *Radar in Scotland 1938-46* for further details.

Chain Home Beam (CHB)
These stations used GCI equipment in the early warning role, passing aircraft movements into the reporting organisation, rather than controlling fighters directly. See pp 45-46 of *Radar in Scotland 1938-46* for further details.

Chain Home Low (CHL)
A radar, operating on a wavelength of 1½ metres, developed by Air Ministry scientists to provide better coverage against low-flying aircraft than Chain Home stations could provide See pp 36-43 of *Radar in Scotland 1938-46* for further details.

Commanding Officer (CO)
The officer in command of a military unit or station.

Defence Teleprinter Network (DTN)
A private communications network installed for the British military by the GPO and Standard Telephones and Cables Ltd from 1939 onwards. The network connected the three services together and to their subordinate units. This linked RAF Fighter Command, its Group and Sector Stations together, allowing for the rapid transmission of messages and information by teleprinter.

Dias
A raised platform at one end of a room that someone can stand on when speaking to a group, or in a military context a platform for senior staff, usually officers, to view a plotting table from an elevated position.

Direction Finding (D/F)
Equipment which used a radio signal from a friendly aircraft to calculate its position.

ENSA
Entertainments National Service Association, an organisation established in 1939 to provide entertainment for military personnel during the Second World War.

Fighter Sector Headquarters (FSHQ)
The main Operations Block of an RAF Fighter Sector, containing the Sector Operations Room and other functions.

Fog Investigation and Dispersal Operation (FIDO)
Introduced into service in November 1943, FIDO used aviation fuel pumped along pipes at the side of runways and out through burner jets. The vapourised fuel was then ignited and the heat evaporated the fog above the runway, making it possible for aircraft to land at FIDO-equipped airfields in heavy fog conditions.

General Post Office (GPO)
The organisation responsible during the Second World War for both postal deliveries and the telephone network in the UK.

Ground Control of Interception (GCI)
A radar station used to control fighters directly, rather than passing information to an operations room from where the fighters were directed. See pp 41-45 of *Radar in Scotland 1938-46* for further details.

Gun Control Centre (GCC)
A smaller, less-important, version of a Gun Operations Room.

Gun Liaison Officer (GLO)
The Royal Artillery officer based in an RAF Group or Sector Operations Room who passes information on aircraft movements to the relevant Gun Operations Rooms for further action.

Gun Operations Room (GOR)
The location from where aircraft movement information is disseminated to anti-aircraft gun batteries and which is in operational command of all anti-aircraft guns within that Gun Defended Area. Renamed Anti-Aircraft Operations Room (AAOR) in late 1942.

High Frequency (HF)
Radio waves at frequencies between 3 Mc/s and 30 Mc/s (megacycles per second, now megahertz) (Smith, 1947: 111).

Historical Radar Archive (HRA)
An independent archive established in 1990 to record and preserve the history of radar.

HQFC
Headquarters Fighter Command.

Identification Friend or Foe (IFF)
A system which made it possible to identify friendly aircraft. A transponder in an aircraft would send out a signal when it received a signal from a ground station. The aircraft's signal would then be received on the ground and identify it as friendly.

In Command (i/c)
The designated individual in command of a unit or station, eg NCO i/c.

Mast
A structure for carrying aerials that is not self-supporting and therefore has to be guyed for support. See tower.

Medium Frequency (MF)
Radio waves at frequencies between 300 kc/s (kilocycles, now kilohertz) and 3 Mc/s (megacycles per second, now megahertz) (Smith, 1947: 112).

Ministry of Civil Aviation (MCA)
The UK Government department responsible between 1941 and 1959 for the development of civil aviation and associated infrastructure, now part of the Department of Transport.

Movement Liaison Organisation (MLO)
The organisation responsible for gathering and disseminating information on friendly aircraft movements, to allow these to be disregarded from plotting tables and thereby focus on hostile or unidentified aircraft.

Movement Liaison Section (MLS)
A unit of the Movement Liaison Organisation at a relevant station such as a filter or operations room.

National Grid Reference (NGR)
A system of geographic grid references devised by the Ordnance Survey in Great Britain.

National Monuments Record of Scotland (NMRS)
The national archaeological database giving information about all known historic and pre-historic sites in Scotland. Accessed via https://www.trove.scot/

National Records of Scotland (NRS)
The Scottish Government department responsible for Scotland's national archives and the registration of births, deaths and marriages as well as the census of Scotland's population.

Naval Officer in Charge (NOIC)
The senior Royal Navy officer in charge of a unit.

Naval Plotting Room (NPR)
The location used for the tracking of the movements of shipping and surfaced submarines.

Non-Commissioned Officer (NCO)
A person appointed from the ranks as a subordinate officer.

Observer Corps
A uniformed civilian volunteer organisation, with posts across the UK, plotting aircraft movements visually or by sound, and passing these to an Observer Centre and from there to Group or Sector Operations Rooms. Known as the Observer Corps until 9 May 1941 when the Royal prefix was granted.

Observer Group Officer (OGO)
Each Observer Group had a Controller and an Observer Group Officer. However, these were the same rank, which could cause confusion if contradictory instructions were issued. Consequently, in 1943, the position of Observer Group Officer was deleted and each Observer Group was commanded by the new post of Group Commandant.

Orkney and Shetland Defences (OSDef)
The British Army formation responsible for the anti-aircraft, coast artillery and anti-invasion defences in Orkney and Shetland.

Operations 'A', or Ops 'A'
Sub-Controller, who assisted the Fighter Controller in an Operations Room and their duties included helping them to operate and use the communications systems.

Operations 'B', or Ops 'B'
Deputy Controller, who assisted the Fighter Controller in an Operations Room and their duties included listening in to all telephone conversations, recording orders and compliances and dealing with confirmatory teleprinter messages.

Private Branch Exchange (PBX)
A telephone switchboard, usually manually operated with a plug board and cables, which allows for the routing and switching of calls from a single site into the telephone network.

Private Manual Branch Exchange (PMBX)
A manually operated PBX.

Radio Direction Finding (RDF)
One of the cover names given to British radar, until the word radar was adopted in 1943.

Radio Telephony (R/T)
Radio messages sent by speech, like a telephone, rather than by Morse code.

Royal Air Force (RAF)
The independent air force of the UK.

Royal Air Force Volunteer Reserve (RAFVR)
Formed in 1936 to provide a reserve of air force personnel in the event of war. During the Second World War, the Air Ministry used the RAFVR as the main means of entry for personnel into the RAF, with all volunteers plus those called up for service in the RAF joining as RAFVR members.

Royal Artillery (RA)
The formation of the British Army responsible for the use of artillery, including anti-aircraft guns.

Royal Naval Air Station (RNAS)
An airfield or other station of the Fleet Air Arm, which was the air arm of the Royal Navy.

Royal Observer Corps (ROC)
A uniformed civilian volunteer organisation, with posts across the UK, plotting aircraft movements visually or by sound, and passing these to an Observer Centre and from there to Group or Sector Operations Rooms. Known as the Observer Corps until 9 May 1941 when the Royal prefix was granted.

Sandra
Sandra beacons, or Sandra lights, were used on airfields in a group of three to form a cone, the tip of the cone indicating the height of the cloud base for departing aircraft.

Sector Operations Room (SOR)
The Operations Room of an RAF Fighter Sector, from where fighter aircraft are controlled. See also FSHQ.

Stanmore
The name given to the Filter Room at HQFC and co-located at Bentley Priory.

Sub-Filter Room (SFR)
A small filter room which dealt with plots from local radar stations before passing the filtered information to the Filter Room at RAF Fighter Group Headquarters. This avoided congestion at the Group Filter Room.

The National Archives (TNA)
Formerly the Public Record Office and responsible for the UK national archives.

Tower
A self-supporting structure (and therefore not guyed) for carrying aerials. See also mast.

Trove
The online database of the National Monuments Record of Scotland.

Very High Frequency (VHF)
Radio waves at frequencies between 30 and 300 Mc/s (megacycles per second, now megahertz), with VHF communications and VHF D/F usually in the band 100 – 150 Mc/s (Smith, 1947: 112).

Vulnerable Point
This was a strategically important location, such as a military installation, eg a radar station, or a factory producing vitally important war materials, which were to be defended from air and ground attack.

Watcher Post
An Observer Post without a direct telephone line to the Observer Centre and instead used a private telephone or public telephone box to pass aircraft reports to Centre.

Wireless Telegraphy (W/T)
Radio messages sent by Morse code, rather than by speech.

Wireless Observer Unit (WOU)
RAF personnel used to perform a similar role as the Observer Corps in passing visual or sound plots of aircraft movements, but not as volunteers as with the Observer Corps. As the name suggests WOU personnel passed aircraft plots by radio, as they operated from sparsely populated areas without telephone lines.

Women's Auxiliary Air Force (WAAF)
The women's branch of the Royal Air Force. WAAF telephone and teleprinter operators were amongst the first women to replace men in the RAF, with substitution at the rate of 75% (Air Ministry, 1953: 88). The first WAAF to be employed in Operations Rooms were Clerks, Special Duties, or Plotters. They also substituted men at the proportion of 75% and at 1 July 1943 there

were 7,395 WAAF so employed. Filterer, Air Raid Warning Liaison and Movement Control Liaison posts were also filled by WAAF officers, with substitution at 50% (Air Ministry, 1953: 97).

Women's Royal Naval Service (WRNS)
The women's branch of the Royal Navy. Members were known as Wrens.

Y Service
The term applied to units of all three services (British Army, Royal Navy and Royal Air Force) as well as the Foreign Office and GPO, which were intercepting enemy radio transmissions. Many of these messages were then sent to the Government Code and Cypher School at Bletchley Park for decrypting. The HQ of the RAF Y Service was at Cheadle in Staffordshire (Clayton, 1993: 50).

Young Men's Christian Association (YMCA)
A Christian youth organisation that provided social facilities including canteens (both fixed and mobile) for service personnel during the Second World War.

ZZ
This was the radio code for a controlled approach to an airfield by an aircraft. Using a Homer D/F station, the Flying Control Officer in the control tower at the airfield would request a transmission from the aircraft every 30 seconds, which produced bearings from the Homer. The Flying Control Officer used these bearings to guide the aircraft into the correct position and course to land at the airfield.

Note about measurements

All measurements are given in the units in use at the time. This is mostly imperial measurements, but metric for radio/radar wavelengths. The conversions for the measurements are as follows:

1 inch = 2.54 centimetres
1 foot = 0.3048 metres
1 yard = 0.9144 metres
10,000 yards = 9.144 kilometres
1 mile = 1.60934 kilometres
1mph = 1.60934 kph

Foreword

> "Those who cannot remember the past are condemned to repeat it" (George Santayana (16 December 1863 – 26 September 1952) - philosopher, essayist, poet and novelist).

It is a great pleasure and real honour to write the foreword to Ian Brown's second book – telling the story of the Air Defence System in Scotland in World War 2. Ian is exceptionally well-qualified to write on this subject, bringing decades of dogged research, real subject matter expertise and an unbridled passion for his subject to help bring this extraordinary and less-known story to life. As part of the National Museum of Flight team in East Lothian, he has been a real ally during my time as Air Officer Scotland as we have worked together to seek to preserve and promote Scotland's unique place in aviation history, including the creation of the nascent Scottish Aviation Trail.

Whilst the technologies and nation states involved have obviously changed from those in 1938-1946, the principles of Air Defence remain largely unchanged to this day across the spectrum of conflict. This becomes even more apposite because the enduring factors of geography (i.e. Scotland's location on the Northern flank of the United Kingdom) and the need to maintain 'control of the air' (as a vital part of military operations and to ensure homeland security) are as relevant today as they were nearly a century ago.

Providing early warning of the risk of an incursion into UK airspace and then the means of projecting a rapid and effective means of deterring – or if needs be neutralising – a threat to our nation is one of the key roles at the heart of the Royal Air Force's 'to do' list. Scotland's part in that remains as vital as ever and today's FGR4 Typhoon fighters, P-8A Poseidon Maritime Patrol aircraft and the in-bound early warning E-7 Wedgetail at RAF Lossiemouth on the Moray Firth are on call 24/7 to protect us all. Just as in 1938-1946, radar and many other technologies remain a key aspect in long range air defence and yet again geography matters; in response to current needs, Shetland's recently reopened radar site at Saxa Vord

on Unst is testament to this. The much-quoted line from George Santanya at the top of the page perhaps says it all?

But as ever, all the very best technology under the Sun is for nothing if you do not have the right people, trained and ready to use it. Ian's book brings this crucial aspect to life – and the many photos and vignettes of this turbulent period in our nation's history show the true mettle of the men and women who served to defend our homeland from up here in Scotland and across the rest of the UK. Having recently retired after 40 busy and happy years in the RAF, it was marvellous to see that, whilst much has changed since those days, the stuff that really matters has not and the Royal Air Force's unique flair, dedication and professionalism remains underpinned by our sense of humour and being part of the 'RAF family'.

Life is full of marvellous surprises, and when Ian asked if I might be prepared to write a Foreword to his book – which is a huge privilege in its own right - I had no expectation that it might also solve a long standing gap in my family knowledge of what my dear old Mum did as a LACW Plotter at HQ 11 Group (Fighter Command) at RAF Bentley Priory during the war. It was thus very special to see pictures of the various underground operations rooms at Bentley Priory and, whilst I could not see her amongst those photographed, to know that she could have named them all and brought it all to life again. I thus owe Ian much, personally, for helping me to understand at long last what she did all those years ago as part of the national air defence effort.

To conclude – Ian has produced another superb book, shining a light on the fundamental and key role Scotland played in the air defence of the UK in the last world war. He has made complex topics easily accessible to the reader – but for me, Ian's genius has been to enable us all to catch a glimpse of just some of those involved in air defence in Scotland and what they did for all of us, saving our country from invasion.

The men and women of today's Royal Air Force stand ready, at this very moment, doing just the same.

Air Vice-Marshal Ross Paterson CB OBE DL BSc PGCE FCIPD RAF (retired)
Air Officer Scotland (2014 – 2023)

Acknowledgements

As with my previous book, *Radar in Scotland 1938-46*, this one could not have been written without the assistance and support of a considerable number of people. To everyone who has helped me in the course of my research I extend my deepest thanks and my apologies to anyone I may have inadvertently left out.

I am particularly grateful to Dr Iain Maoileoin for his help. He bought the former Raigmore Filter Block in March 2019 and has been extremely helpful in sorting out the history of the complex of buildings that formed the Fighter Group Headquarters there, as well as providing access to the building.

Exceptional thanks go to the wartime veterans of radar stations and filter and operations rooms that freely shared their experiences with me. Sadly, these individuals are considerably less in number than were thanked in *Radar in Scotland 1938-46*, as the wartime generation is gradually lost to us. Nonetheless, the following have been of tremendous help: EV Adcock, Alison Catto, Joe Eltringham, Ian Hill, Joy Moore, Mowbray Pearson and Ethel Russell. I would also like to thank Charles Struthers, whose father was the Observer Group Officer and later Group Commandant of No 35 Group, ROC, for making his father's papers freely available.

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Similar thanks must also be extended to Mark Dawson, who has produced three amazing diagrams showing the interconnections in the air defence system in 1940 and 1942. Although complicated, these diagrams clarify even more complicated hand-drawn originals and are little short of miraculous in their beauty and clarity.

Thanks are also due to the various individuals and organisations that very kindly gave permission for the use of images or quotations from published works. They are Bentley Priory Museum, Christian Lamb, DC Thomson & Co Ltd, Faber & Faber, the Friends of Orkney Wireless Museum, Grub Street Publishing Ltd, Harper Collins, Historic Environment Scotland, The Institute of Telecommunications Professionals, Mike Hughes, The National Archives, National Museums Scotland, Oban War and Peace Museum, Royal Air Force Museum, Skye and Lochalsh Archives and University of the Third Age Perth Branch. Every attempt has been made to contact copyright holders and obtain permission for use of their material. If any such individual or company believes they have been omitted, do please contact the publishers so that any issues can be resolved.

I must thank Air Vice-Marshal Ross Paterson for writing the foreword to this book. I have known Ross for several years and his dedication to education, not only in the history of the RAF but especially in STEM (science, technology, engineering and mathematics) subjects is a credit, and I hope this book is worthy of his contribution.

Finally, I must acknowledge the help and support from family and friends that has allowed this book to be produced. My long-standing friend Kevin Anderson freely opened up his home allowing for frequent research trips to The National Archives to take place. Perhaps most of all I wish to thank my mum, Elizabeth, and my wife, Anne, for their support over the years, allowing time for the research and writing of this book, and hope they feel it was all worthwhile.

PART I

Introduction

> 'It would be difficult to justify the absence of a warning system for any part of the country.' Scottish Office official (TNA, AIR 41/11).

Conventional wisdom dictates that Britain was saved from invasion by Nazi Germany as a result of the victory of the Royal Air Force over the German Air Force, or *Luftwaffe*, in the Battle of Britain between 10 July and 31 October 1940. The general perception is that these aerial combats, fought almost exclusively over Kent and the south-east of England, were, with the exception of the V1 flying bomb and V2 rockets, the only air attacks on the UK during the Second World War. Nothing could be farther from the truth.

On 16 October 1939, just over six weeks after Britain declared war on Germany, the first air attack took place, not in SE England, but in the Firth of Forth. The first German aircraft shot down onto British soil since the First World War was not over London, but over Scapa Flow, and the first to crash largely intact did so in East Lothian. In addition, in March and April 1940, the German Air Force made several large raids on the Royal Navy's Home Fleet at Scapa Flow. Whilst the immediate aim of the German attacks was to protect the invasion of Norway, had they succeeded in destroying the Home Fleet at this early stage of the war, it would have been a blow comparable to that of Pearl Harbour against the US Pacific Fleet. Britain would have been extremely vulnerable, and the outcome of the war could have been very different.

German aircraft were in Scottish airspace almost every day, when weather conditions permitted flying, throughout the war. Again, conventional wisdom is that the last operation of the German Air Force over Britain was directed against Norfolk on 20 March 1945 (Ramsey, 1990: 547). In fact, on 10 April 1945 a reconnaissance flight was carried out by a single Arado Ar 234 jet bomber based at Stavanger in Norway. It crossed the North Sea and made a high-altitude photographic run over Scapa Flow, then went south as far as the Moray Firth before returning to its base. This was the last sortie flown by the German Air

Force over the UK (Jackson, 1996: 55). Thus, from almost the very start until almost the very end of the war, German air activity was directed against Scotland, but little has been written about this. In contrast, much has been written about the air defence system in the UK during the Second World War. However, this is almost exclusively concerned with SE England. Most published maps showing the layout of the air defences show only southern England or, occasionally, the whole of mainland Britain, but rarely include Orkney or Shetland, despite the fact that, as previously mentioned, these islands saw hostile air activity throughout the entire war.

This then, is an attempt to tell the story of these defences, how they were organised and operated, of the men and women who staffed them, and of the response they provided to the many hostile threats and attacks made on Scotland. It is intended as a companion volume to my previous book, *Radar in Scotland 1938-46*, which was published by the Society of Antiquaries of Scotland in 2022. That put into print for the first time an account of all the radar stations in Scotland between 1938 and 1946. The present volume puts that work into its wider context, showing how the radar information, combined with visual plotting by the Royal Observer Corps and others, was processed and used to respond to these attacks.

This book covers the air defence system in significantly more detail than was possible in *Radar in Scotland 1938-*46. Some of that information, particularly the details of the Fighter Sector Stations, was based on secondary sources. These sources largely gave the dates for when the airfields were operational, which was not always the same as the dates for the Fighter Sector Headquarters. Using primary sources to identify exactly when these FSHQs opened and closed, as well as more detailed research into the history of the entire air defence system as it applied to Scotland, has revealed a picture far more complex than previous published accounts, including official histories of the Second World War, would suggest.

As with *Radar in Scotland 1938-46*, the source material for this book is drawn mainly from the official records, held at The National Archives in Kew, supplemented by additional original documents held by the Historical Radar Archive. These records reveal the work of the RAF Group and Sector Stations (and the fighter squadrons under their control), the British Army Anti-Aircraft Command Gun Operations Rooms and the Royal Navy Naval Plotting Rooms which received radar information and used this to respond to hostile activity. These records have been given human stories from first-hand accounts by many men and women who served on these stations all across Scotland, many who were sent from Commonwealth countries to help defend the UK. The air defence centres were highly secret and photographing them was a serious offence for both military and civilian personnel. It is amazing therefore that any photographs exist.

This book is divided into three sections. Part I consists of this introduction and four chapters, with Chapter 1 giving an overall history of the development of the air defence system in Scotland and the part it played during the Second World War. Chapter 2 gives an explanation in detail of the filtering and plotting processes, by which raw data from radar stations was interpreted to create an

estimated true picture of aircraft positions and movements, and this information was transmitted to various operations rooms for further action. Knowledge of this process is key to understanding the challenges and issues faced by the whole air defence system during this period.

Chapter 3 explains the work of the Movement Liaison Organisation, which played a key role in the air defence system but which is rarely, if ever, mentioned in the published histories. The MLO was responsible for providing information on the movements of friendly aircraft, particularly aircraft from Bomber and Coastal Commands, approaching the British coast and likely to be detected by the radar chain. The information from the MLO was intended to avoid wasting resources intercepting friendly aircraft and hence was key to allowing the proper direction of fighter aircraft towards incoming hostile attacks.

Chapter 4 looks in detail at the communications networks that were vital to the operation of the air defence system. The warnings provided by the radar chain and Observer Corps were only useful if the information was communicated to the air defence centres from where the information could be interpreted and used to direct the fighter aircraft to intercept. The communication of this information was therefore vital to the process. If the radar chain and Observer Corps have sometimes been described as the eyes and ears of the RAF, and the operations rooms were the brains, then the communications networks were the nerves that transmitted this data.

Part II is the main body of this book, containing histories of each individual air defence centre covering Scotland. The entries all begin with a summary, giving type of site; the current local authority area as at 2026, or the island within this local authority area where relevant; the national grid map reference, accurate to 10 metres as an eight-figure reference (or in the case of Torry Battery to 100 metres as a six-figure reference); the National Monuments Record of Scotland (NMRS) site number, which contains information about the site and its current state and the database can be accessed via the Trove website: https://www.trove.scot/ (note this only applies to the sites in Scotland); and lastly the dates the station opened and closed. Some of this information will be repeated within the site history, but a quick-reference summary may be useful.

Part III, rather than dealing with an aspect of the air defence system, looks at the parallel system for tracking shipping. Using information from the RAF Chain Home Low, Naval Coast Defence U-boat and Army CD/CHL radar stations, and later improved centimetric radars, this information was fed to Naval Plotting Rooms which tracked shipping movements in inshore waters and plotted any hostile surface craft attacking convoys around the coast. Although this naval system was largely separate from the air defence system which is the focus of this book, it was an important element into which radar information was fed. Despite this, little has ever been written about this and this section attempts to tell this story for the first time though histories of each individual Naval Plotting Room covering Scotland.

The aim of this book is to provide a detailed and accurate description of the air defence system in Scotland between 1938 and 1946, with an obvious focus on

the Second World War. It is hoped this book will be of value to military historians, local historians, genealogists, historians of the Second World War and historians of modern Scottish history. All will, it is hoped, find something of interest within this book, the first to tell the story of the air defence system in Scotland, covering each individual air defence centre and based mainly on primary sources and first-hand accounts. This book was written as a result of more than 35 years of research into this subject, prompted by the lack of published information about the air defence system in Scotland. It is hoped this book finally tells an accurate story of this system, in this case in the context of sites located in Scotland, but will be of interest even to those whose curiosity on this subject is not limited to the geographical area of Scotland.

Chapter 1

The Air Defence System in Scotland 1938-46

In 1916, for the first time Scotland was attacked from the air. On the night of 2/3 April two Zeppelins operated by the German Imperial Navy, L14 and L22, planned to attack Rosyth Naval Base but instead attacked Edinburgh and Leith (Cole & Cheesman, 1984: 122-123) with high explosive and incendiary bombs. A whisky bond belonging to Innes & Grieve was hit and caught fire, being totally destroyed and 13 people were killed (NRS, HH31/21/8). Bombs were also dropped at Lamberton and Chirnside (Morris, 1925: 89). Naval aircraft took off from East Fortune and Dundee, but failed to intercept the airships (Morris, 1925: 90), and indeed Flight Sub Lieutenant Cox, the pilot of the Avro 504C which took off from RNAS East Fortune, not only failed to find the Zeppelins but crashed on landing back at East Fortune. He was injured and his aircraft was badly damaged (Cole & Cheesman, 1984: 123).

Although there were aircraft deployed to defend Scotland at this time, there was no air defence system. Once a threat was identified, and aircraft took off, the pilots were on their own. There was no ground control directing to the hostile airships and no means (other than the pilot's own eyes) of identifying the current location of the attacking airship. With the cessation of hostilities on 11 November 1918, and then the end of the First World War with the signing of the Versailles Treaty on 28 June 1919, the threat of air attack disappeared. Throughout the 1920s and most of the 1930s, Scotland remained without an air defence system. Even as late as 1935, the Reorientation Scheme envisaged a continuous defence zone that extended from Portsmouth to the Tees, with Newcastle as a separate defended port, but everything north of that left undefended (Collier, 1957: 33).

The development of radar changed the nature and extent of the air defence system in the UK. Work on radar began in the UK in 1935 and developed rapidly, initially at Orfordness in Suffolk and later at the Bawdsey Research Station, also in Suffolk. However, attempts at Bawdsey between 19 and 30 April 1937 to locate aircraft flying on pre-arranged courses over the North Sea had produced tracks which mostly bore no resemblance to the true positions of the aircraft. The Air Officer Commanding-

in-Chief of Fighter Command, Air Chief Marshal Sir Hugh Dowding, regretted he could not accept the information in the state it appeared for use in his operations rooms.

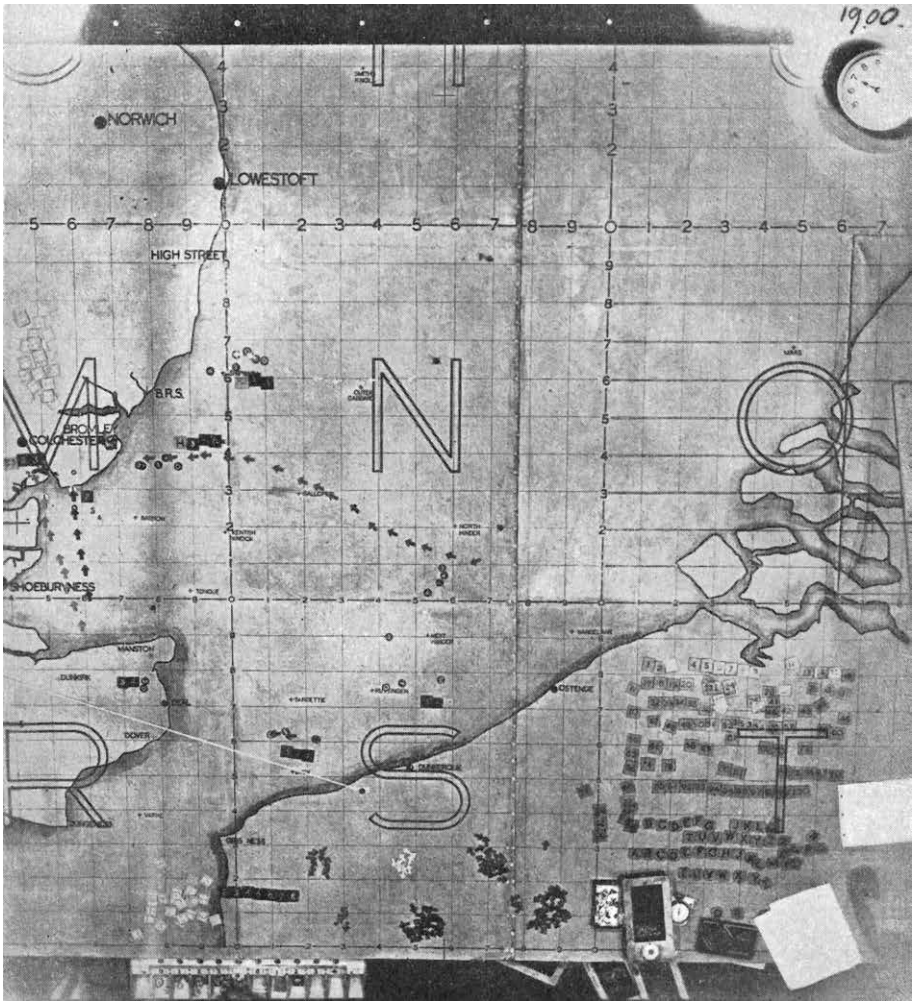
It was generally agreed following the trials at Bawdsey in April 1937 that an improvement in tracking would result if radar stations were sited close enough together to ensure that every bit of the coast was covered by at least two stations. In this way a 'range cut' could be obtained, whereby the position of an aircraft could be determined from the intersection of two accurate range measurements. This method would, however, require a reporting or filtering centre where the observations of several stations could be combined. The most accurate information would be produced by this filtering process and then passed to operations rooms for use in interception (Air Ministry, 1952: 21).

An experimental filter centre was installed at Bawdsey in July 1937, the main feature being a map table covering the approaches to the Thames Estuary. On this table, reports of aircraft positions as received from the Chain Home radar stations at Bawdsey, Canewdon and Dover, were plotted. By the end of November 1937 the tracks obtained by filtering were being passed by telephone to the operations rooms at Headquarters Fighter Command, Headquarters No 11 Group and Sector Headquarters Biggin Hill. In January 1938 the filter centre equipment was moved to a new building at Bawdsey, known as No 2 Filter Room, which had been specially designed with the benefit of the experience gained. This new facility was lined with sound-absorbing material and a larger map table covered the coastal area from Dover to Norwich (Air Ministry, 1952: 23).

The first large-scale test of the new interception system took place during the annual Home Defence Exercise in August 1938. The Chain Home radar stations at Dover, Dunkirk, Canewdon, Great Bromley and Bawdsey passed their plots to the filter centre at Bawdsey. Filtered plots were told from Bawdsey, simultaneously to Fighter Command and No 11 Group Operations Rooms, and to the Sector Headquarters at Biggin Hill, Hornchurch and North Weald. The filter centre successfully handled the increased information, regulating the efforts of the various radar stations and telling them which tracks to concentrate on and which to disregard (Air Ministry, 1952: 28).

Unfortunately, the plotting of information in most of the operations rooms was not very successful, due mainly to the lack of practice and experience of their staff. However, the Home Defence Exercise in 1938 helped with planning the new interception organisation in Fighter Command as a whole. The Bawdsey Filter Centre was to be moved to larger accommodation in Fighter Command Headquarters. Special telephone lines were to be provided for reporting aircraft information. Operations Rooms were to be better staffed and the staff were to have more frequent practice, shorter shifts and better ventilation (Air Ministry, 1952: 28-29).

Despite the work on this embryonic air defence system, Scotland remained outside the air defence of the UK. However, this changed with the growing international crisis due to German territorial claims over the Sudetenland. On 16 September 1938 the Deputy Chief of the Air Staff and Director of Operations and Intelligence at the Air Ministry, Air Vice-Marshal Richard Peirse,



1 Bawdsey Filter Room table, photographed during the Home Defence Exercise in August 1938 (© Historical Radar Archive).

ordered that mobile radar equipment should immediately be set up at Drone Hill near St Abb's Head, Ravenscar in Yorkshire and West Beckham in Norfolk (Air Ministry, 1950: 45). As a result, 12 days later on 28 September 1938 Drone Hill went on the air (TNA, AVIA 7/299), the first operational radar station in Scotland, providing early warning coverage for the Forth-Clyde area and in particular the vital naval base at Rosyth. Drone Hill was capable of detecting aircraft at 7,000 feet at a distance of 60 miles out to sea, which would give Edinburgh 20 minutes warning of an air attack approaching at 240 miles per hour (Air Ministry, 1950: 46). At that time there was no filter room at Headquarters Fighter Command at Bentley Priory in Middlesex and hence Drone Hill acted as its own filter room until 8 November 1938, when plots then passed to Stanmore Filter Room at Bentley Priory (Air Ministry, 1950: 46; Wood with Dempster, 1990: 89).

As a result of the experiences of the 1938 Home Defence Exercise it was decided on 23 September that a permanent underground Operations Block was to be built at Bentley Priory. The plans included accommodation within the block for a filter room. However, as a result of the Munich Crisis in September 1938 a temporary filter room was prepared in the basement of the Priory. There, the minimum of aircraft reports necessary to conduct operations could be filtered (Air Ministry, 1952: 30). This temporary filter room, known as Stanmore Filter Room, became operational on 8 November 1938 (Wood with Dempster, 1990: 89). By the end of 1938 the temporary filter room arrangements included a complete telephone system and a map table covering the east and south coasts of Britain, the North Sea and the English Channel (Air Ministry, 1952: 30).

This began the air defence system that supposedly operated throughout the UK during the Second World War, although in reality was far more complex. In the theoretical system, information from radar stations would be told by telephone line to Stanmore Filter Room, where it was used to produce an estimated true picture of aircraft movements. This 'true' plot was passed from the filter room to Fighter Command Operations Room in Bentley Priory, Fighter Command Group and Sector Operations Rooms simultaneously. In the operations rooms, decisions were made on how to deal with the attack and instructions would then be given to the fighter squadrons to take off and intercept the raid, or 'scramble'. The fighters would be directed from the ground until the hostile aircraft were spotted visually, at which point the fighter leader would give the instruction 'Tally ho', signalling that the enemy had been sighted and that instruction from the ground would cease (Brown, 2022: 21). The air defence system in Scotland from 1938 until 1946 was, however, not quite as simple and straightforward.

No 12 (Fighter) Group was formed at Uxbridge in north London on 1 April 1937, moving to its permanent home at Hucknall in Nottinghamshire on 19 May. The Group was ostensibly responsible for the defence of the northern half of the UK (TNA, AIR 25/219). However, it was only with the Munich Crisis in September 1938 over German claims to the Sudetenland that active defences in Scotland were created. A mobile early warning radar unit was established at Drone Hill in Berwickshire, operating from 28 September 1938 (TNA, AVIA 7/299). It was nearly a month later, on 24 October 1938 that No 603 (City of Edinburgh) Squadron, Royal Auxiliary Air Force, based at RAF Turnhouse, was transferred to Fighter Command (TNA, AIR 27/2079). As a result Scotland, or at least the Central Belt, finally became part of an air defence system, with a means of detecting approaching hostile aircraft and fighter aircraft to intercept them. A few months later, on 14 January 1939, No 602 (City of Glasgow) Squadron, based at RAF Abbotsinch, also transferred to Fighter Command (TNA, AIR 27/2073), providing a second air defence squadron in Scotland. However, until the formation of No 13 (Fighter) Group, Turnhouse Sector acted more independently of No 12 (Fighter) Group Headquarters than the other Sectors in No 12 Group (TNA, AIR 16/48).

During 1939, responsibility for the air defence of Scotland passed from No 12 to No 13 (Fighter) Group, the latter established with its Headquarters at

Kenton Bar in Newcastle-upon-Tyne on 24 July 1939. On 1 August No 13 Group took over the following stations and squadrons:

Church Fenton	Sector 'M'	No 64 Squadron	Bristol Blenheims
		No 72 Squadron	Supermarine Spitfires
Yeadon		No 609 Squadron	Hawker Hinds
Catterick	Sector 'O'	No 41 Squadron	Supermarine Spitfires
Usworth	Sector 'P'	No 607 Squadron	Gloster Gladiators
Turnhouse	Sector 'S'	No 603 Squadron	Gloster Gladiators
Abbotsinch		No 602 Squadron	Supermarine Spitfires

The same day, the following Observer Corps Groups were placed under the control of No 13 Group.

Manchester	No 7 Observer Corps Group
Leeds	No 8 Observer Corps Group
York	No 9 Observer Corps Group
York	No 10 Observer Corps Group
Lancaster	No 29 Observer Corps Group
Durham	No 30 Observer Corps Group
Galashiels	No 31 Observer Corps Group
Carlisle	No 32 Observer Corps Group
Glasgow	No 34 Observer Corps Group
Dunfermline	No 36 Observer Corps Group
Dundee	No 37 Observer Corps Group
Aberdeen	No 38 Observer Corps Group (TNA, AIR 25/232).

This remained the Group and Sector organisation at the outbreak of war on 3 September 1939.

With the expansion of Usworth Fighter Sector to cover Scotland south of Turnhouse Fighter Sector, by the end of 1939 the south of Scotland was covered by just two Sectors: Usworth and Turnhouse (Collier, 1957: map 12).

An additional Fighter Sector Headquarters opened at Wick in February 1940 (TNA, AIR 28/917). The creation of a Fighter Sector at Wick was part of a requirement for improved defences for Scapa Flow, resulting from the decision by the Admiralty in January 1939 that the Home Fleet would use Scapa Flow as the Main Fleet Base (Hewison, 1990: 233). Following this, it was decided to extend the radar chain towards Scapa Flow (Air Ministry, 1950: 60). A radar station was set up at Netherbutton in Orkney on an emergency basis, becoming operational on 2 June 1939 (TNA, AVIA 7/308). However, this station was located outside the area covered by the existing Fighter Groups and Sectors and consequently it was decided that Netherbutton would not tell to Stanmore Filter Room. Instead, it would report to a local filter room where the information would be of direct use. The plots would then be passed for information purposes to Stanmore. The local filter room was set up at Wick, although the Fighter

2 Royal Air Force Fighter Command No 13 Group and Sectors, 3 September 1939 (© Historic Environment Scotland).

3 Royal Air Force Fighter Command No 13 Group and Sectors, December 1939 (© Historic Environment Scotland).

4 Royal Air Force Fighter Command No 13 Group and Sectors, June 1940 (© Historic Environment Scotland).

Sector HQ there did not become operational until February 1940 (TNA, AIR 28/917). Netherbutton was, therefore, the only Chain Home radar station not plotting directly to Stanmore at the outbreak of war. Plots continued to be told by Netherbutton to Wick until 25 September 1940 when Kirkwall Filter Room opened (TNA, ADM 116/5790, AIR 26/92).

Another Fighter Sector opened at Dyce in May 1940 (TNA, AIR 28/235), filling the gap between the Turnhouse and Wick Sectors. Dyce Sector was ideally placed to make use of early warning information from Hillhead Chain Home radar which had become operational during December 1939 (TNA, AVIA 7/257) and intercept hostile aircraft approaching Scapa Flow from the south and south-east.

Further re-organisation came on 29 June 1940 with the formation of No 14 (Fighter) Group at Drumossie Hotel near Inverness. Although formed in June, it was not until 30 August that the Group took administrative control of the following units:

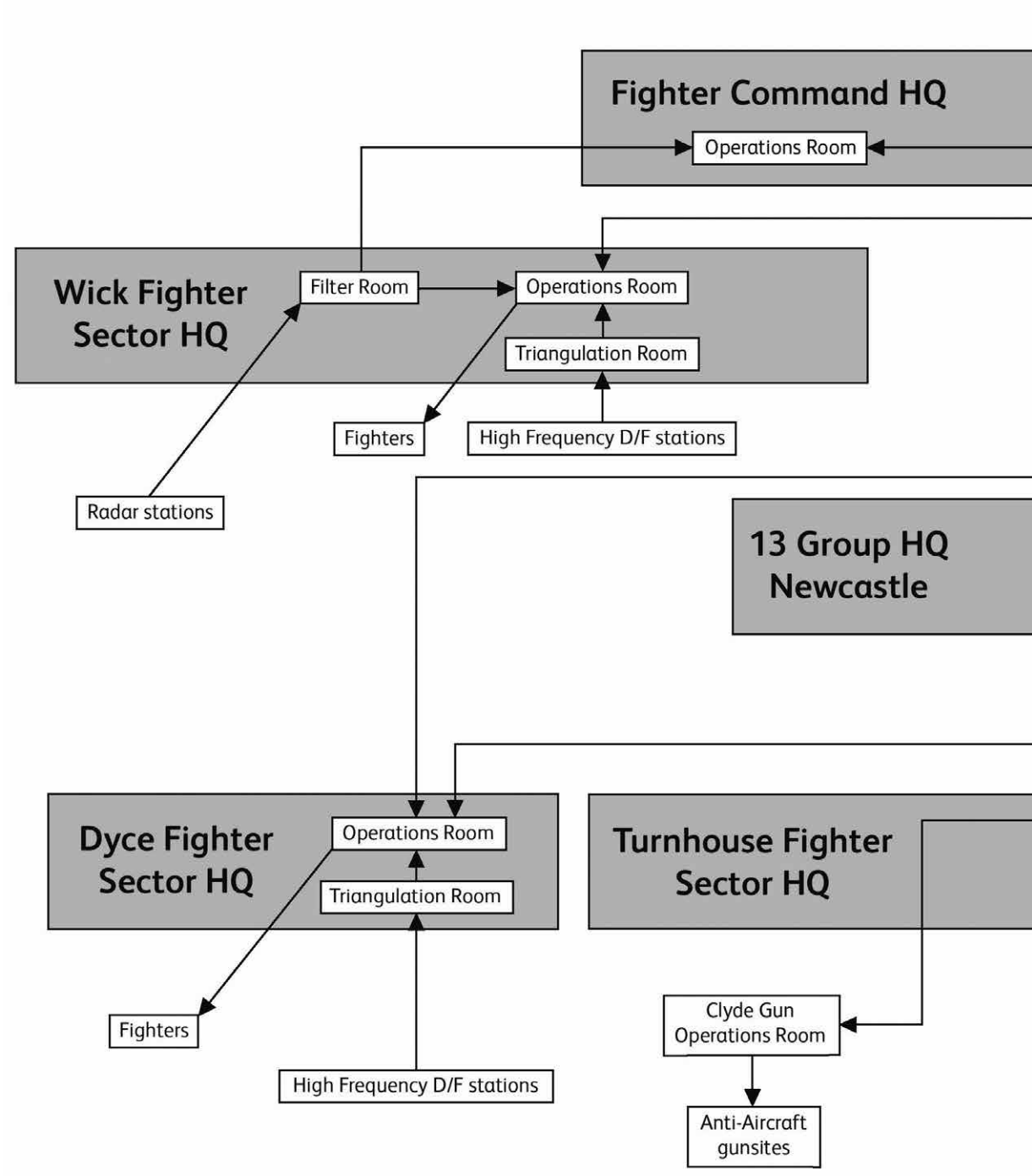
RAF Station Castletown
RAF Station Skeabrae
Sector HQ Wick
Sector HQ Dyce
Sector HQ Bignold Park, Kirkwall

No 3 Squadron
No 141 Squadron
No 232 Squadron
No 504 Squadron

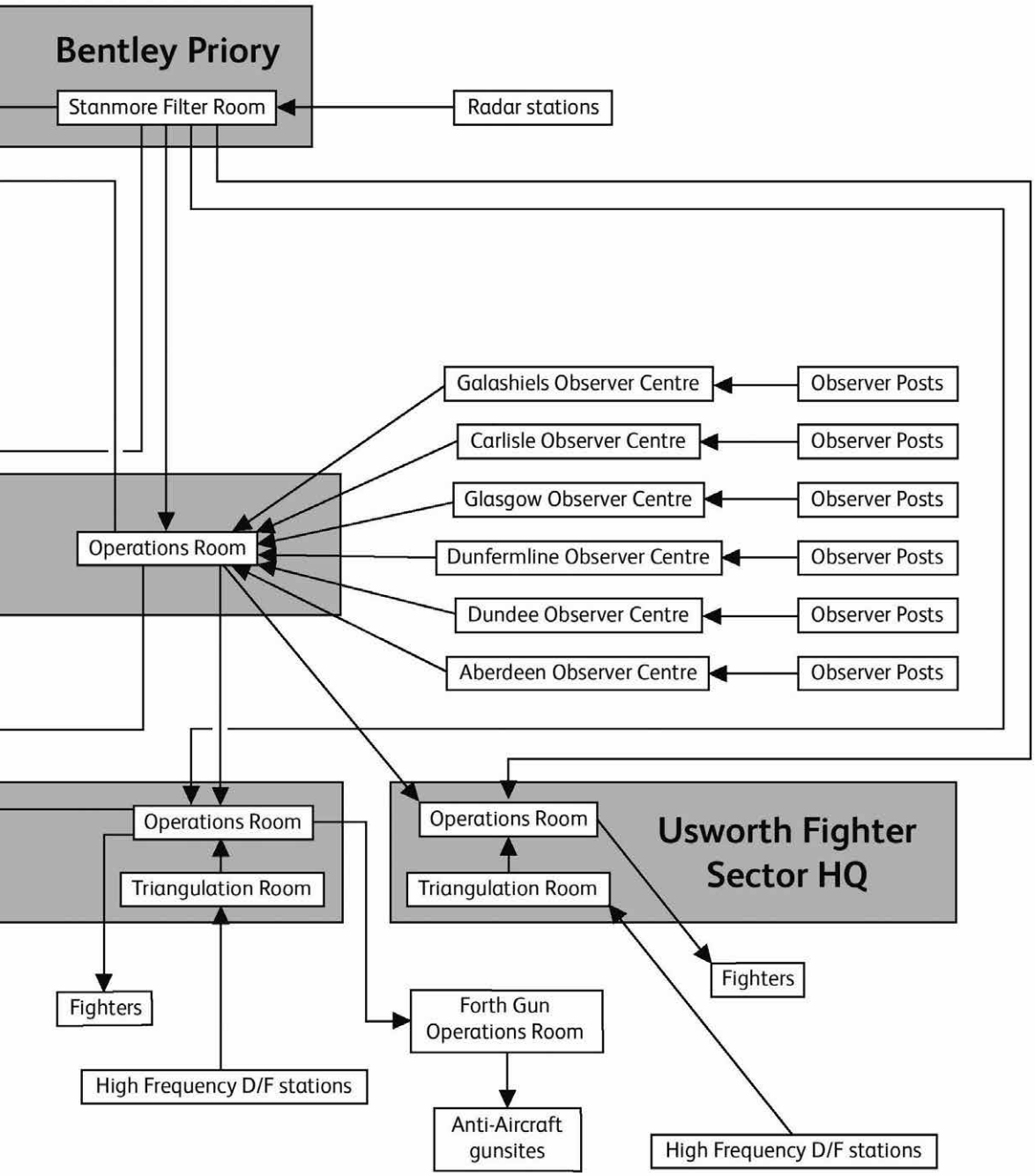
The Group commenced operations on 14 October 1940, at which time the following units formed the Group Order of Battle:

No 3 Squadron	Castletown
No 111 Squadron	Dyce & Montrose
No 232 Squadron	Castletown
No 804 Squadron	Fleet Air Arm at Hatston (TNA, AIR 25/250).

In June 1940 No 10 (Fighter) Group was formed, covering SW England and South Wales (Sturtivant, 2007: 149), with the Group Headquarters at Box in Wiltshire (Air Ministry, 1950: 135). A filter room was set up at Portsmouth at the same time, moving to the Group HQ at Box at the end of June 1940 (Air Ministry, 1952: 54). Nearly two months later, in August 1940 No 9 (Fighter) Group was formed (TNA, AIR 25/177), covering NW England, North Wales and the West Midlands. The North-Western Filter Room at No 9 Group Headquarters at Barton Hall in Lancashire commenced operating at 9am on 13 August 1940 (TNA, AIR 29/141). With the formation of these two Fighter Groups and their filter rooms, Wick (moved on 25 September 1940 to Kirkwall) no longer occupied a unique position in the UK air defences as the only devolved filter room. Instead,



5 The air defence system in Scotland in March 1940 (Designed and illustrated by Dawson Creative).


Bentley Priory
Stanmore Filter Room
Radar stations
Galashiels Observer Centre
Observer Posts
Carlisle Observer Centre
Observer Posts
Glasgow Observer Centre
Observer Posts
Operations Room
Dunfermline Observer Centre
Observer Posts
Dundee Observer Centre
Observer Posts
Aberdeen Observer Centre
Observer Posts
Operations Room
Triangulation Room
Operations Room
Triangulation Room
Usworth Fighter Sector HQ
Fighters
Fighters
Forth Gun Operations Room
High Frequency D/F stations
Anti-Aircraft gunsites
High Frequency D/F stations

plots from radar stations in Nos 9, 10 and 14 Groups were all told to local filter rooms, with only Nos 11 (covering SE England), 12 (covering the East Midlands) and 13 Group radar stations plotting to Stanmore Filter Room at Headquarters, Fighter Command (Air Ministry, 1950: 135). In December 1940 it was decided to decentralise the entire filtering process to Fighter Group Headquarters. This involved protracted work on landlines, and it was not until September 1941 that all Fighter Group filter rooms were operational (Air Ministry, 1952: 54).

In early December 1940 telephone communication with the Shetland Islands was provided via a submarine cable. Cable breakdowns occurred in January 1941 which resulted in a temporary break in telephone communications between the radar stations in Shetland and Kirkwall Filter Room. As a result, an emergency filter room was opened at Sumburgh on 29 January 1941 to deal with radar information from Shetland. After a few weeks, telephone communication was restored but the temporary filter room remained at Sumburgh until eventually moved to Lerwick (HRA, RDF in Northern Scotland and the Islands).

In the air defence system, radar was not the only source of information. Tracking of aircraft both visually and also by sound alone (when conditions did not permit visual plotting, such as when cloudy) was carried out by the Observer Corps (known from 9 April 1941 as Royal Observer Corps (Wood, 1992: 112)). The role of the Corps was as follows:

1. To pick up tracks told by the radar system as they made landfall.
2. To 'tell' upwards to Sectors and Groups the continued tracks of hostile and of doubtful aircraft.
3. To pass forward from Observer Group to Observer Group tracks of friendly aircraft but not to tell the latter tracks upwards unless requested by a higher formation (TNA, AIR 41/11).

Plots from individual Observer Posts were passed by telephone to Observer Centres, the functions of which were as follows:

1. To receive reports from its Posts of all aircraft seen or heard flying.
2. To filter that information, ie to arrange in series the separate reports received and to reconcile conflicting reports and hence deduce the composition, height and track of every aircraft flying.
3. To identify any of the above tracks that are definitely friendly.
4. To 'tell' to Fighter Group and Sector Operations Rooms the position, composition, height and direction of flight of all aircraft not definitely friendly.
5. To relay to Fighter Group and Sector Operations Rooms, as well as others concerned, all other information relevant in air defence as reported from its Posts (TNA, AIR 10/4040).

As mentioned previously, from 1 August 1939 the following Observer Centres covering areas within Scotland were placed under the control of No 13 (Fighter) Group:

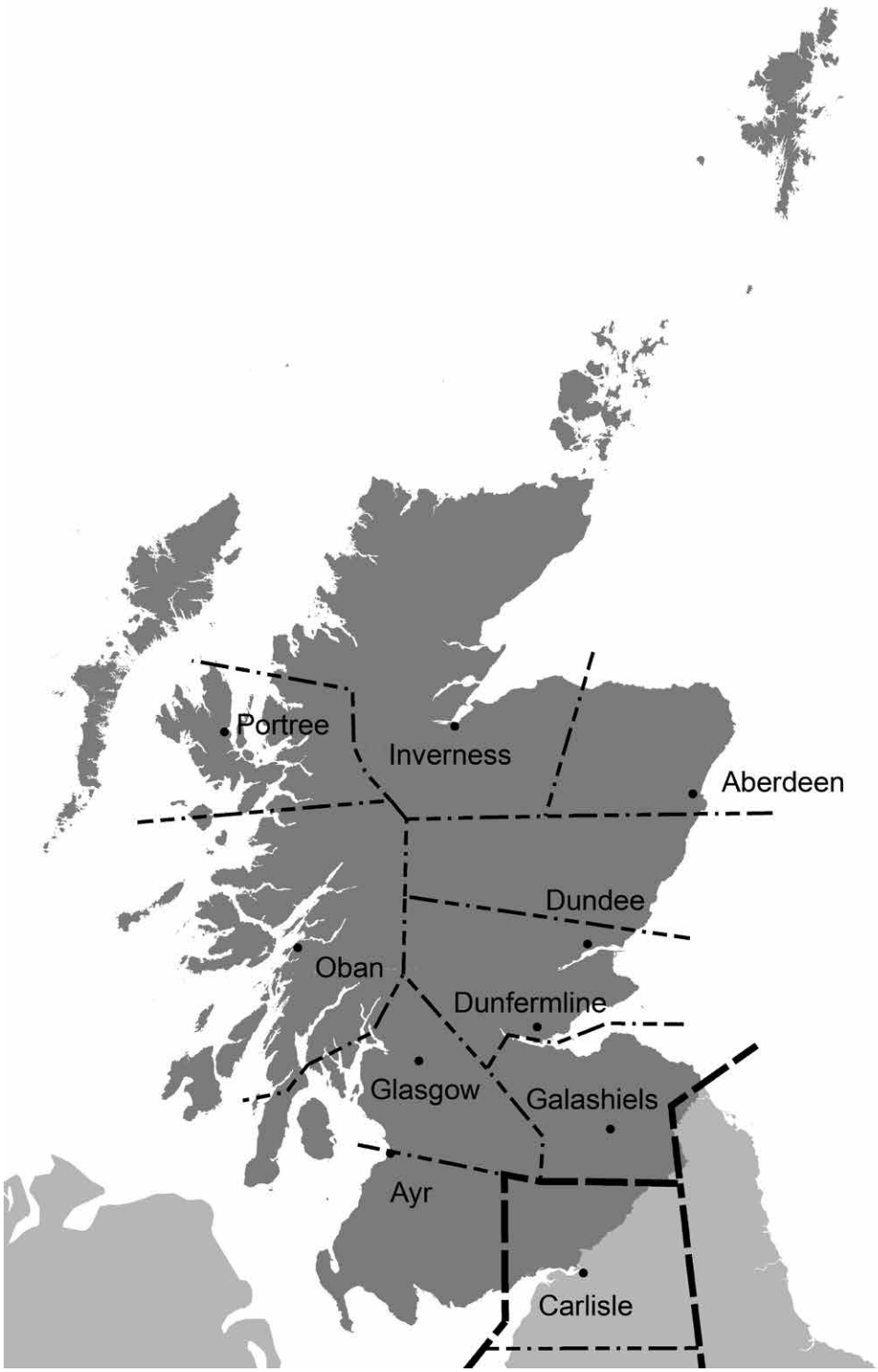
No 31 Observer Group, Galashiels
No 32 Observer Group, Carlisle
No 34 Observer Group, Glasgow
No 36 Observer Group, Dunfermline
No 37 Observer Group, Dundee
No 38 Observer Group, Aberdeen (TNA, AIR 25/232).

It was realised that observer coverage in Scotland was inadequate and consequently additional Observer Groups were created (TNA, AIR 41/11). No 39 Observer Group with its Centre in Inverness was formed in 1939; No 33 Observer Group opened in Ayr and No 35 Observer Group in Oban, both in 1940 (Wood, 1992: 267, 272, 274).

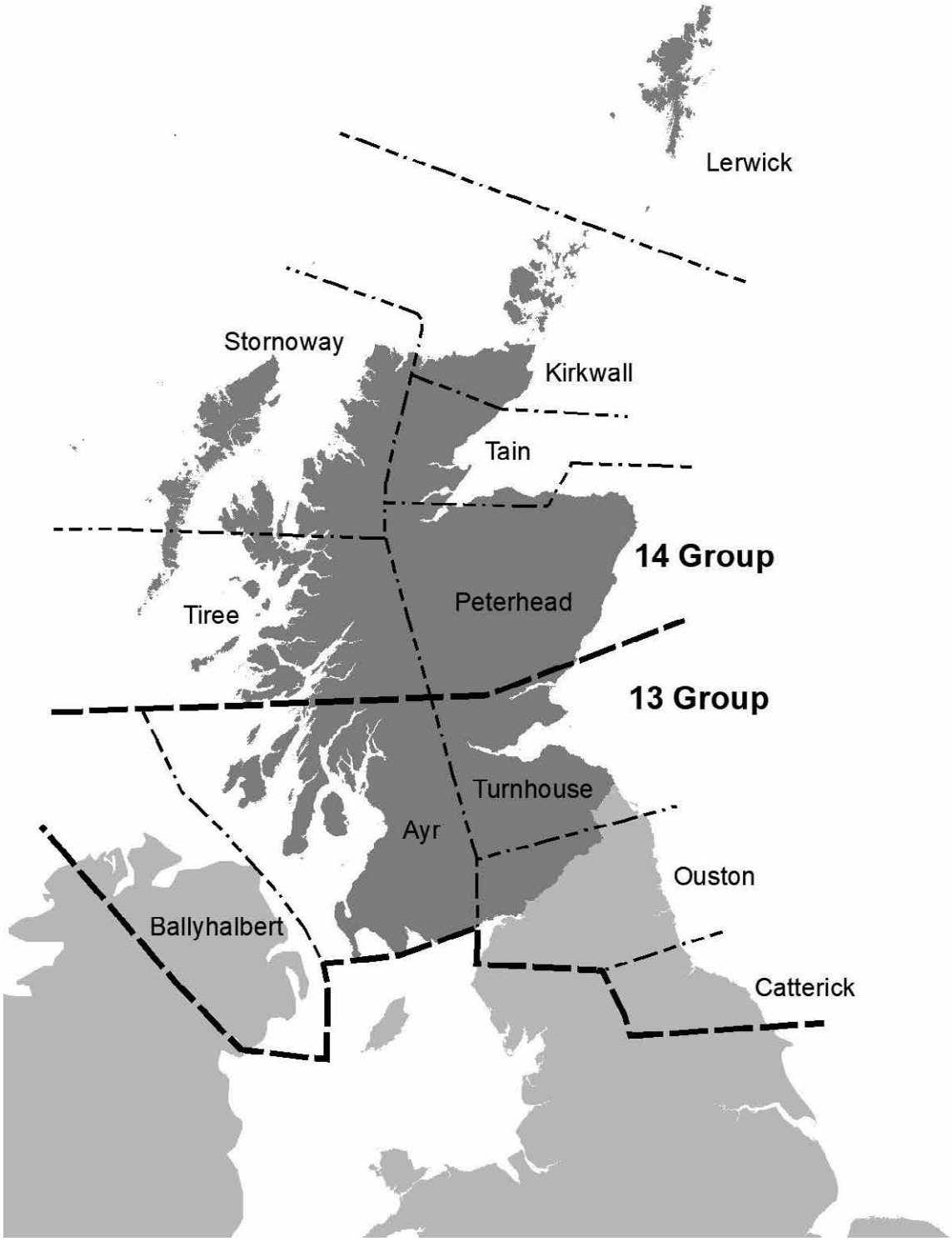
Following the decentralisation of RAF filtering, ROC information was passed from Observer Centres to Fighter Group Filter Rooms (Wood, 1992: 179). There remained no coverage in the North-West Highlands and consequently No 40 Observer Group was formed at Portree in November 1941. Despite this, coverage in the area was incomplete. As a result, in addition to the information from Observer Posts, plots were provided by No 18 Wireless Observer Unit (WOU) (sometimes known as No 18 Wireless Unit) from 1941. Due to a shortage of men in the North-West Highlands, the WOU performed a similar role to the uniformed civilians of the ROC but with RAF personnel. As the unit name suggests, it reported by W/T rather than telephone and was therefore not restricted by the absence of telephone links (TNA, AIR 10/4040). No 18 WOU had posts across much of the Highlands (ROC Museum, WOU reporting to Inverness Centre, WOU reporting to Oban Centre, WOU reporting to Portree Centre), as well as the Orkney Islands (TNA, AIR 16/915). Reports were sent from these posts to the relevant Observer Centre, except for the Orkney posts which reported to Kirkwall FSHQ (TNA, AIR 16/915). On 30 November 1942, No 18 Wireless Observer Unit, which had given inland coverage in the northern and western parts of No 14 (Fighter) Group area, was disbanded (TNA, AIR 25/250).

Administrative control of the Observer Corps Groups was vested in the Scottish Area from formation in 1938. The Headquarters of Scottish Area from 1938 until spring 1940 were at 10 Alva Street, Edinburgh and from spring 1940 until 8 January 1943 at 28 Walker Street, Edinburgh (TNA, AIR 2/20014, AIR 2/20017, AIR 2/20134). The HQ then moved to Stoneyfield House, Inverness, where it was in close proximity to No 13 (Fighter) Group at Raigmore (Winslow, 1948: 179). The Commandant of the Scottish Area from August 1938 until 31 October 1944 was Observer Captain and Air Commodore (retired) Robert Peel Ross. He was succeeded until stand-down by Observer Captain JM Miller, who had been Deputy Commandant of the Scottish Area since 1941 (*The Scotsman*, 31 October 1944; Wood, 1992: 257).

Various re-organisations in the Observer Corps saw Groups moved across different Areas during the war. In 1940 No 32 (Carlisle) Group was transferred to the Northern Area (Winslow, 1948: 179, 187). On 17 April 1941 it was decided



6 Royal Observer Corps Group areas and Group Centres, 1943 – 1945 (© Historic Environment Scotland).



7 Royal Air Force Fighter Command Nos 13 and 14 Groups and Sectors, May 1942 (© Historic Environment Scotland).

that No 33 (Ayr) Group would be transferred to the Northern Area with effect from 20 April (TNA, AIR 41/11). As a result of a major re-organisation of the ROC in 1942, Nos 31 (Galashiels), 34 (Glasgow) and 36 (Dunfermline) Groups were transferred from Scottish Area to Northern Area (TNA, AIR 41/11) and in August 1942 No 32 Group was transferred to the North-Western Area (Winslow, 1948: 130-131, 193). However, on 1 July 1943 the Northern Area was abolished and Nos 31, 33, 34 and 36 Groups re-allocated back to the Scottish Area (TNA, AIR 41/11).

In order to improve fighter coverage in South-West Scotland and in particular over the Clyde and Glasgow, a new FSHQ opened at Prestwick in January 1941, replaced by Ayr in April (TNA, AIR 28/40). This proved particularly timely in view of the heavy night air-raids on Clydeside on 13/14 March, 14/15 March, 7/8 April, 5/6 May and 6/7 May 1941 (Ramsey, 1988: 472-481, 511-513, 588-592). Ouston replaced Usworth Sector in March 1941 (TNA, AIR 28/624). A new sector opened at Tain in October 1941, improving fighter cover between Peterhead and Kirkwall Sectors and in particular for Invergordon naval base and the Cromarty Firth. However, Tain Sector was only operational for just over a year, closing at the end of November 1942 (TNA, AIR 28/917).

The fall of France in June 1940, and the German possession of the French Channel ports meant that British shipping was transferred almost immediately from the English Channel to the North Channel. As a result, the scale of attacks on shipping in the Irish Sea and North Channel grew alarmingly. Benbecula was planned in 1940 as another Fighter Sector, as a forward fighter base for the air defence of the Western Isles (Smith, 2016: 30). An FSHQ was built to a 1940 Air Ministry design (RAF Museum, Benbecula Record Site Plan Site No 1 Airfield, Drawing Number 4852/44) and was certainly operational there (Hughes, 1998: 61). However, there was never a Benbecula Sector as such.

The naval war was intensifying, as a result of the order issued by Adolf Hitler on 6 February 1941 that the German military should direct its full strength against Britain's overseas supplies (Roskill, 1954:338). In early 1941 British intelligence indicated that the German Air Force was about to release between 200 and 250 long-range bombers from night bombing of the UK. Instead, these aircraft would be switched to attacking Atlantic shipping (TNA, CAB 80/26). The War Cabinet Chiefs of Staff Committee discussed measures for strengthening air defences in the North-Western Approaches on 27 February 1941 and agreed that special measures would be taken to complete additional airfields in the Hebrides (TNA, CAB 79/9). There was also a requirement for fighter defence in the Western Isles to respond to a potential German invasion of Ireland, although this threat was never realised (HRA, Air Defence of Scotland and Northern England, Nos 13 and 14 Fighter Groups RAF, 1939-1945). In response to these threats, FSHQs were planned for Stornoway and Oban, with Stornoway opening in November 1941 (TNA, AIR 28/755) and Tiree (selected instead of Oban) in April 1942. However, these were not Fighter Command airfields and only ever operated as Coastal Command stations, with the FSHQs acting as Fighter Command lodgers on the airfields. It seems likely that these plans for

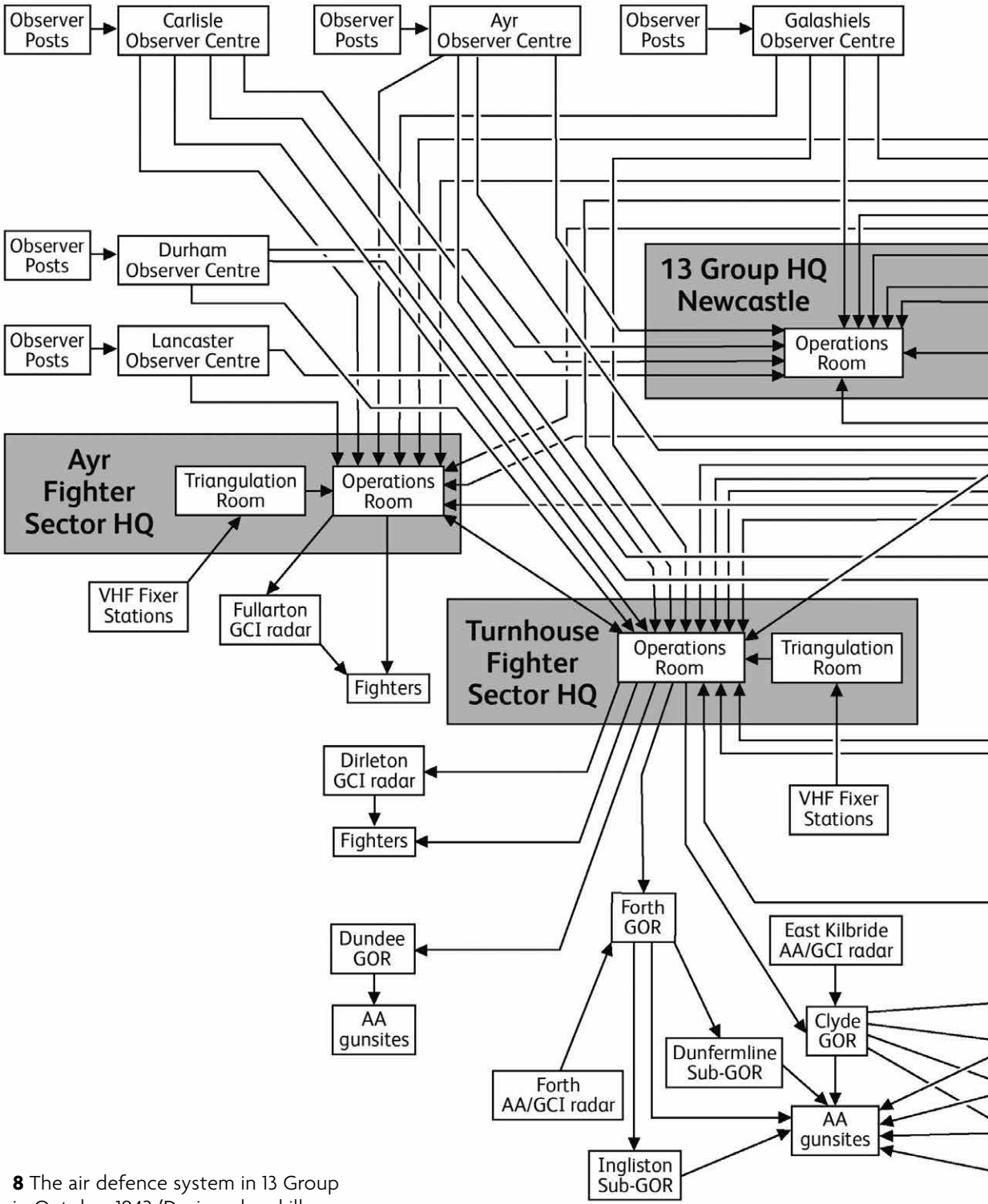
Stornoway and Tiree Sectors superseded the original plan for a Benbecula Sector. It is assumed that the FSHQ at Benbecula operated as a Sub-Sector Operations Room within the Stornoway Sector.

The development of Fighter Sectors in the Western Isles went hand-in-hand with the expansion of the radar chain. New CHL stations, known as the Battle of the Atlantic stations, were opened in the Shetland Islands, Western Isles and the west coast of Scotland at Ben Hough (Tiree), Carsaig (Mull), Clett (Shetland), Eorodale (Lewis), Greian Head (Barra), Islivig (Lewis), Kendrom (Skye), Point of Stoer (Sutherland), Rodel Park (Harris), Sango (Sutherland) and Watsness (Shetland) (Brown, 2022: 14, 60, 71-72, 74-77, 123-126, 140-141, 150-152, 187-188, 191-192, 208-212, 251). These stations were placed to be able to track surfaced U-boats or aircraft (mainly Junkers Ju 88s) attacking shipping in Scottish coastal waters.

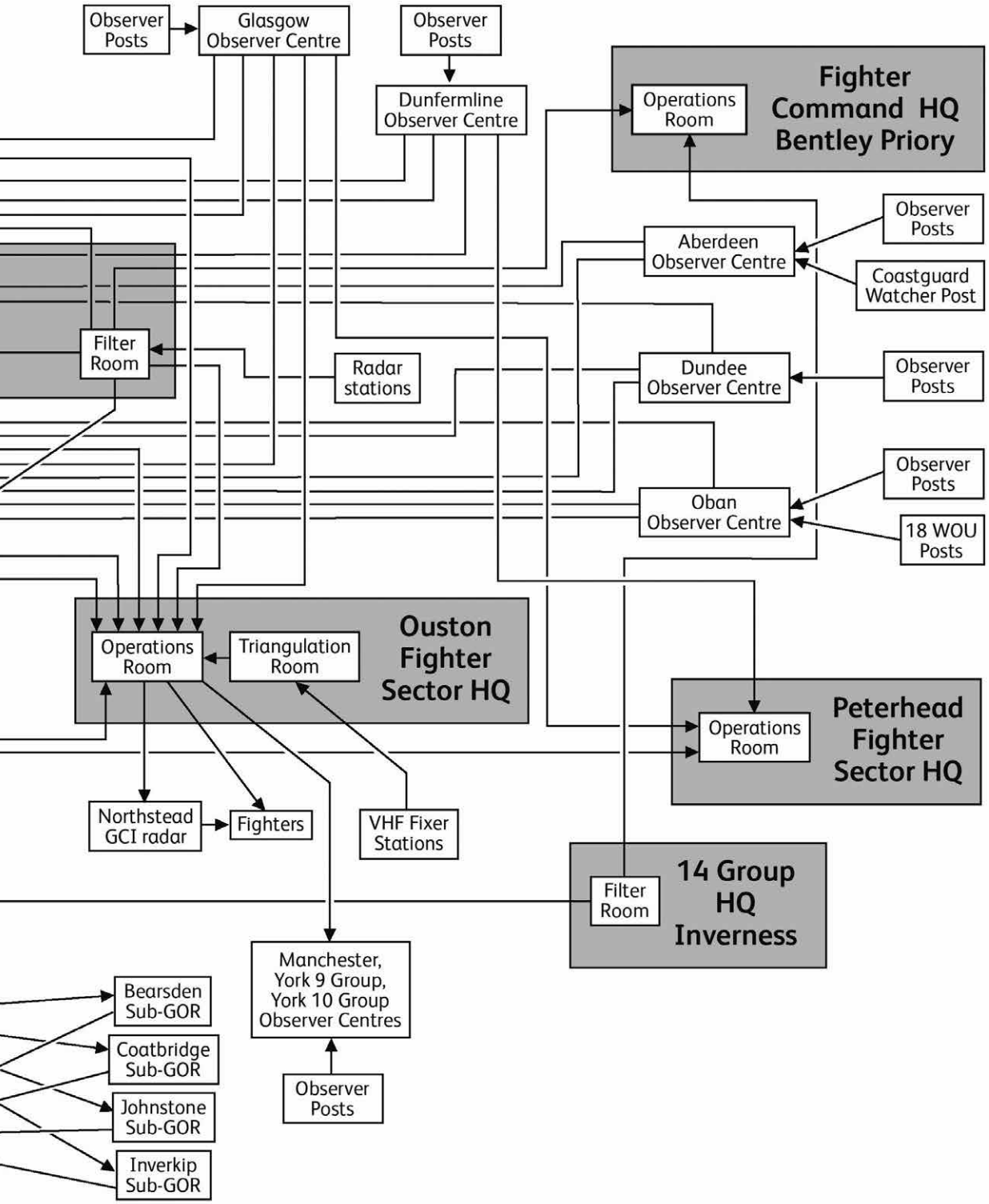
Peterhead Sector opened in May 1942, replacing Dyce Sector which had been operating for two years (TNA, AIR 28/637). This represented the high point of the air defences in Scotland. The sector structure remained like this until November 1942, when sectors began to close, starting with Tiree. These closures were driven by a decrease in air attacks but primarily by a demand for personnel for service overseas and accelerated in late 1943. This was mirrored by a contraction in the radar chain following a review by Fighter Command in November 1943, which concluded that economies in the Home Chain of radar stations would release personnel for overseas service (Air Ministry, 1950: 516). By March 1945 most of the radar stations on the west coast of Scotland had been reduced to a care and maintenance basis (Air Ministry, 1950: 638). These reductions in radar coverage meant there was a reduced need for filter room and operations room staff; the decline in hostile air activity also meant a reduced need for fighter cover and the opportunity to reduce the number of FSHQs, releasing the relevant personnel. Thus, the closure of Tiree in late 1942 was followed by Ayr in May 1943 (TNA, AIR 28/40). In April 1944 No 13 (Fighter) Group Operations Room at Inverness closed down (TNA, AIR 25/234) and consequently full operational control passed to the remaining FSHQs at Lerwick, Kirkwall, Stornoway, Peterhead and Turnhouse. Closures of FSHQs continued, with Peterhead in July 1944, Lerwick in August 1945 and Stornoway in December 1945 (TNA, AIR 28/624, AIR 28/637, AIR 28/755, AIR 28/917).

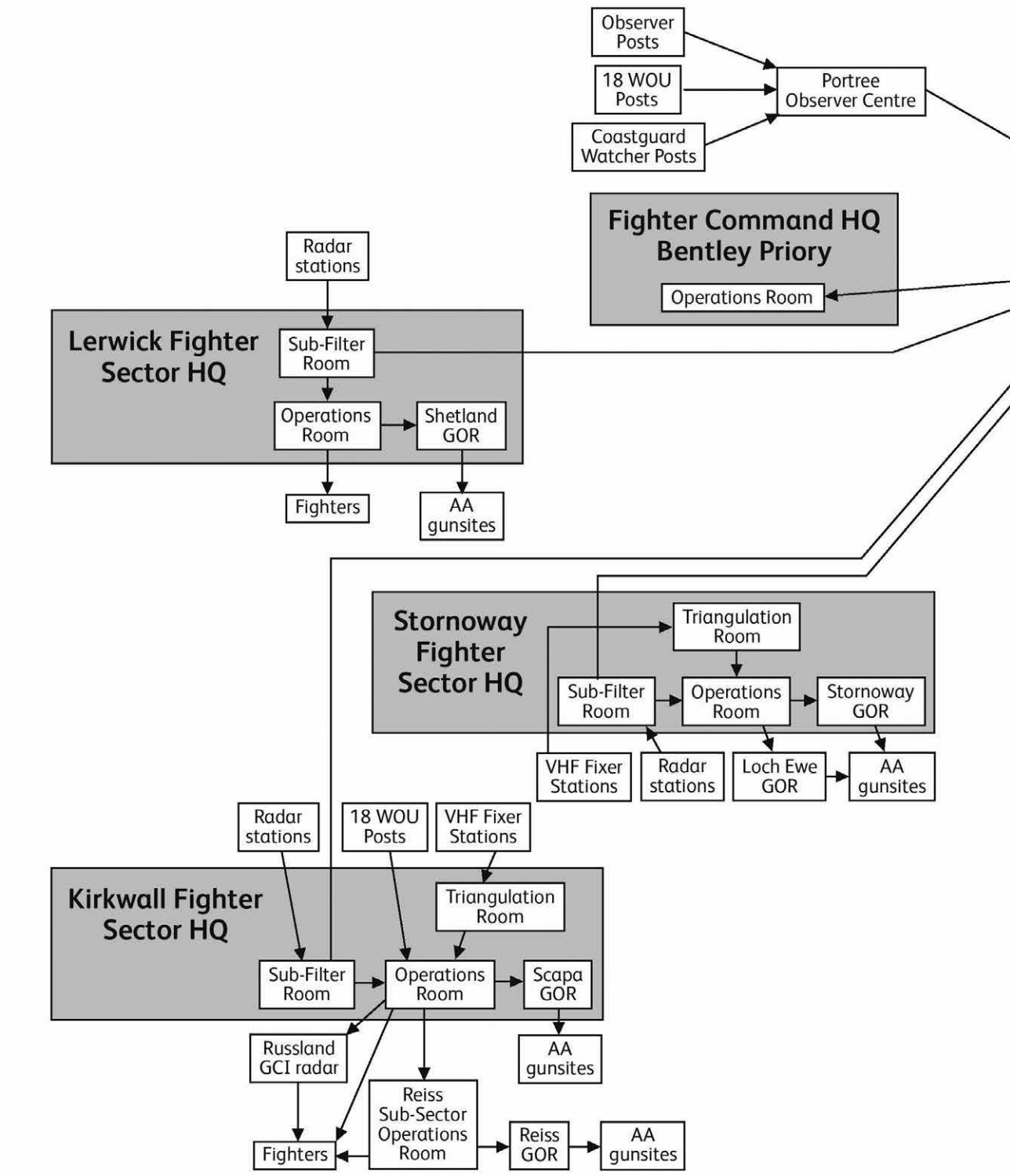
The remaining radar chain in Scotland closed at 4.30pm on 15 March 1946 along with the 13 Group Filter Room at Inverness (TNA, AIR 26/93) and the Orkney FSHQ at Kirkwall (TNA, AIR 28/917). Midlothian FSHQ at Turnhouse survived until the following month, April 1946 (Sturtivant, 2007: 191), as the whole air defence system was stood down.

Fighter Sectors were not, however, the only element of the air defence system. Filtered information on hostile or unidentified aircraft movements was passed from Fighter Group Operations Rooms and information on friendly aircraft from Fighter Sector Operations Rooms to Gun Operations Rooms (GORs). The GOR was the headquarters for an Anti-Aircraft Defence Commander (AADC) in operational command of the anti-aircraft guns within a Gun Defended Area

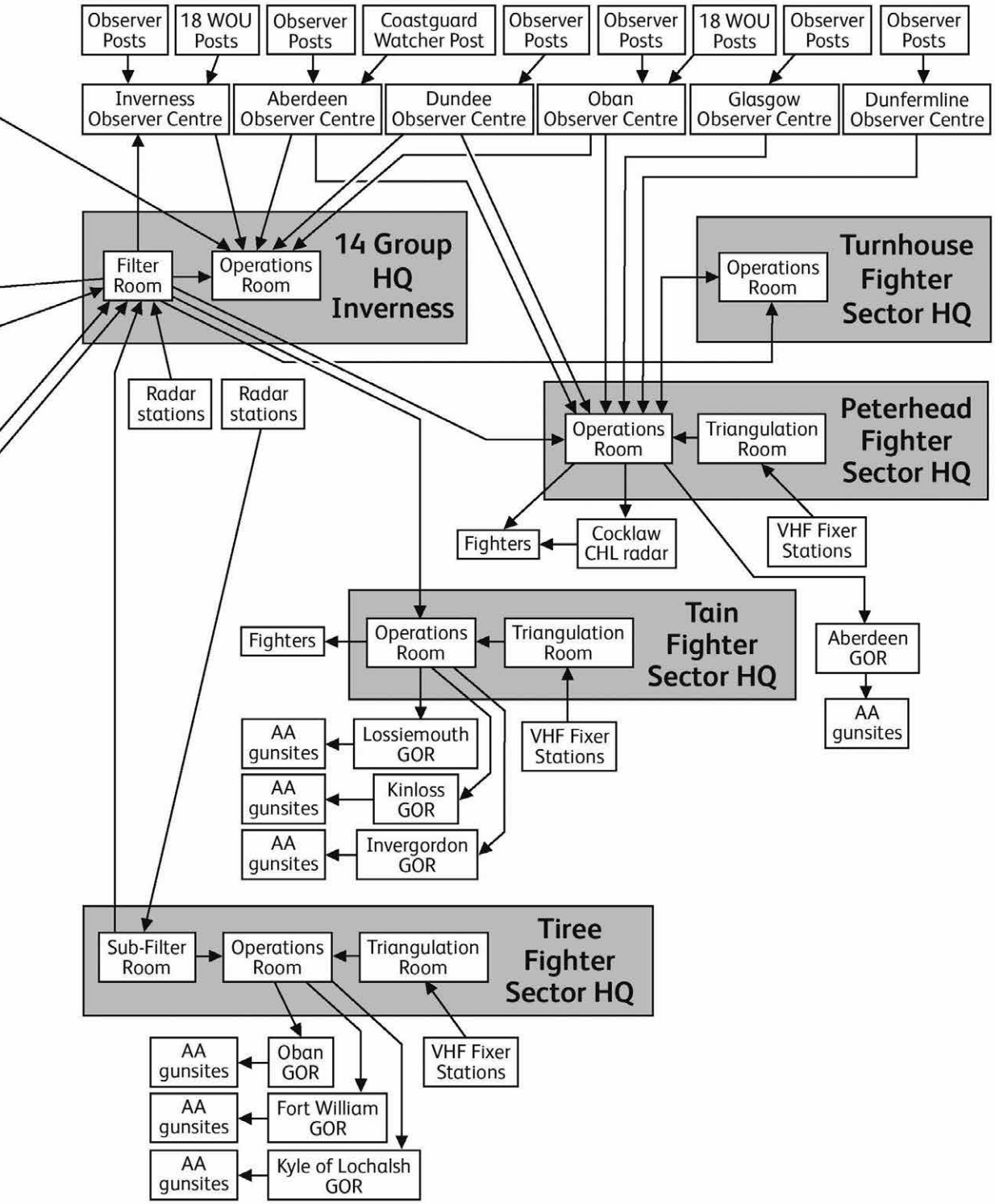


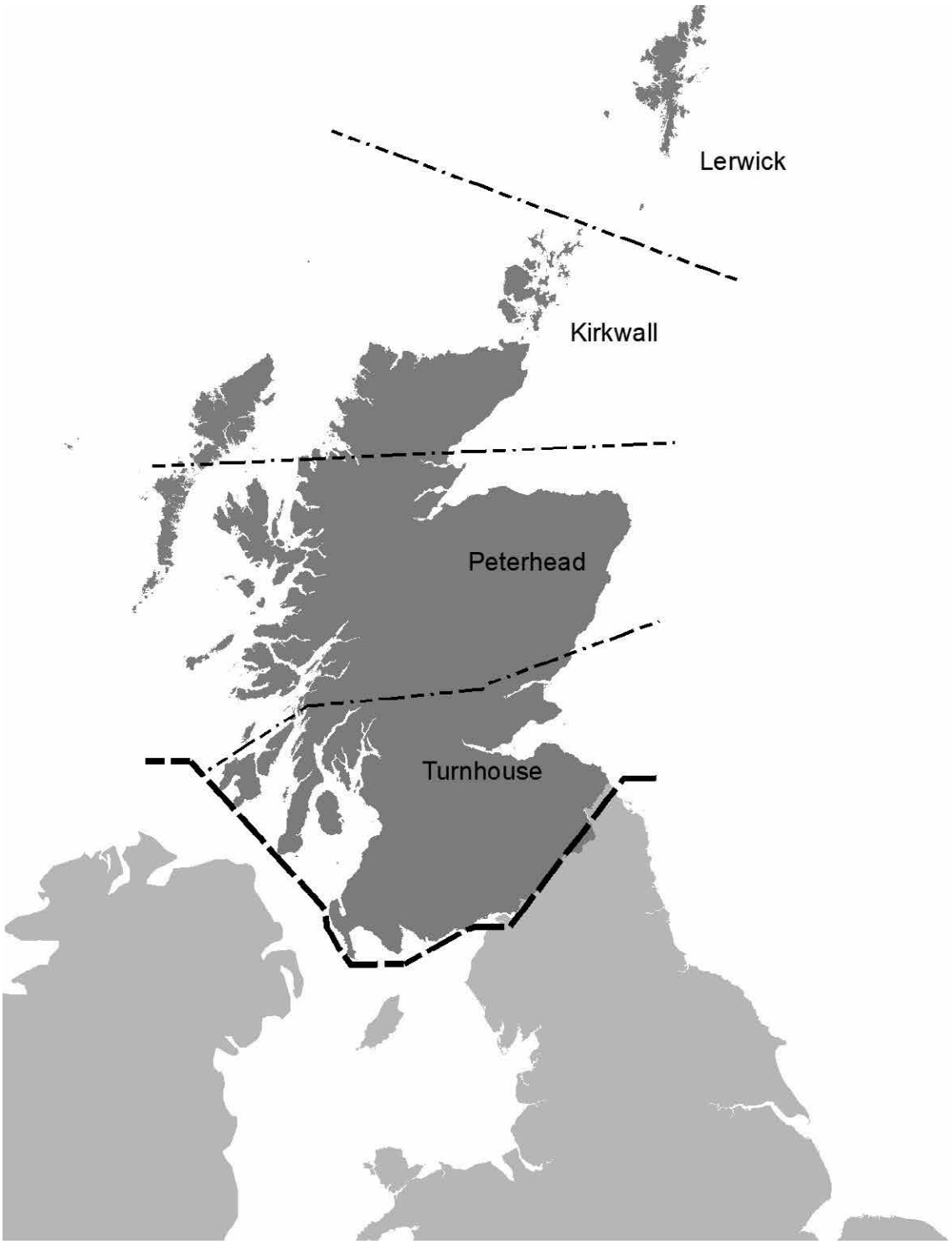
8 The air defence system in 13 Group in October 1942 (Designed and illustrated by Dawson Creative).


Observer Posts
Glasgow Observer Centre
Observer Posts
Dunfermline Observer Centre
Operations Room
Fighter Command HQ Bentley Priory
Observer Posts
Aberdeen Observer Centre
Coastguard Watcher Post
Filter Room
Radar stations
Dundee Observer Centre
Observer Posts
Observer Posts
Oban Observer Centre
18 WOU Posts
Operations Room
Triangulation Room
Ouston Fighter Sector HQ
Operations Room
Peterhead Fighter Sector HQ
Northstead GCI radar
Fighters
VHF Fixer Stations
Filter Room
14 Group HQ Inverness
Manchester, York 9 Group, York 10 Group Observer Centres
Bearsden Sub-GOR
Coatbridge Sub-GOR
Johnstone Sub-GOR
Inverkip Sub-GOR
Observer Posts

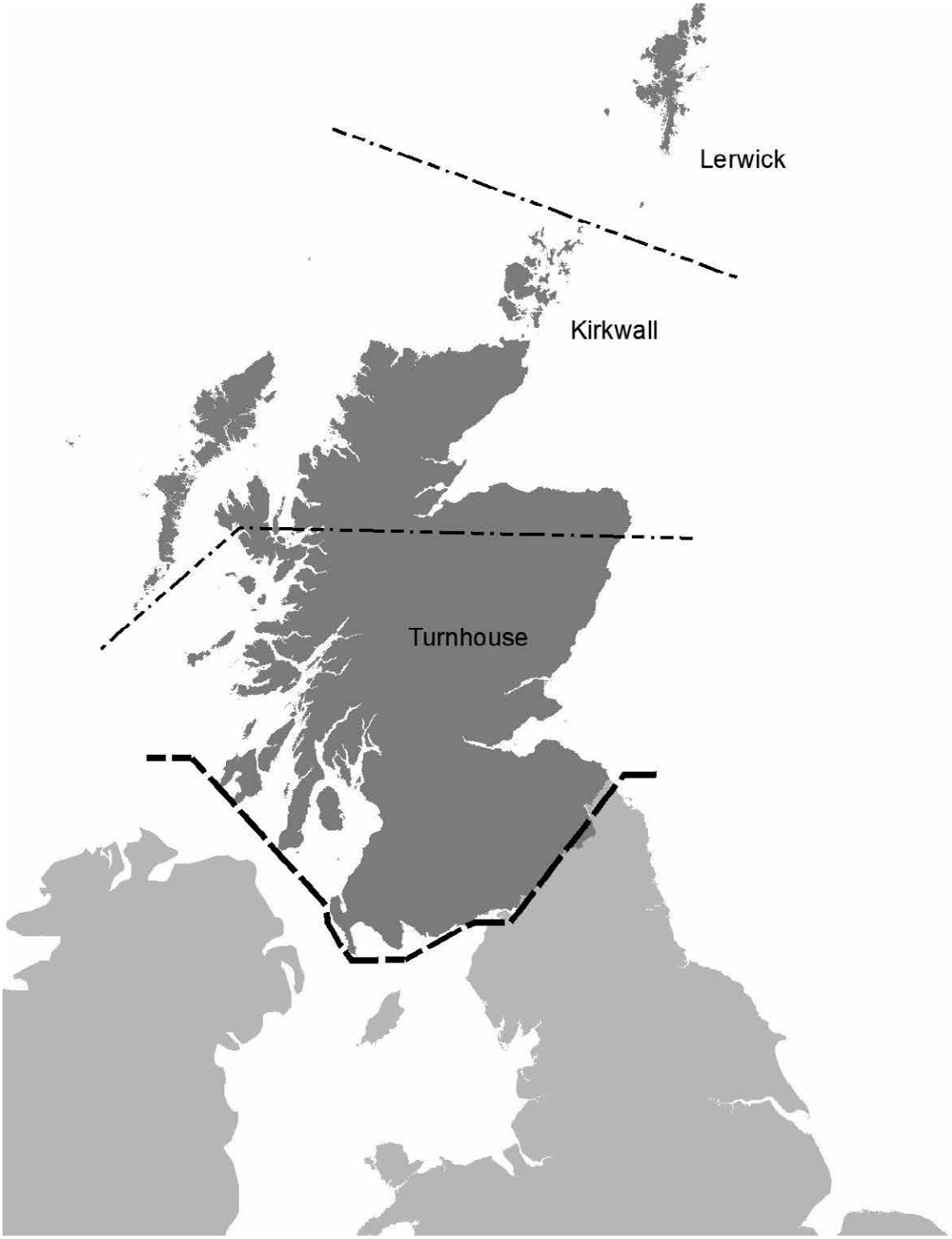


9 The air defence system in 14 Group in October 1942 (Designed and illustrated by Dawson Creative).

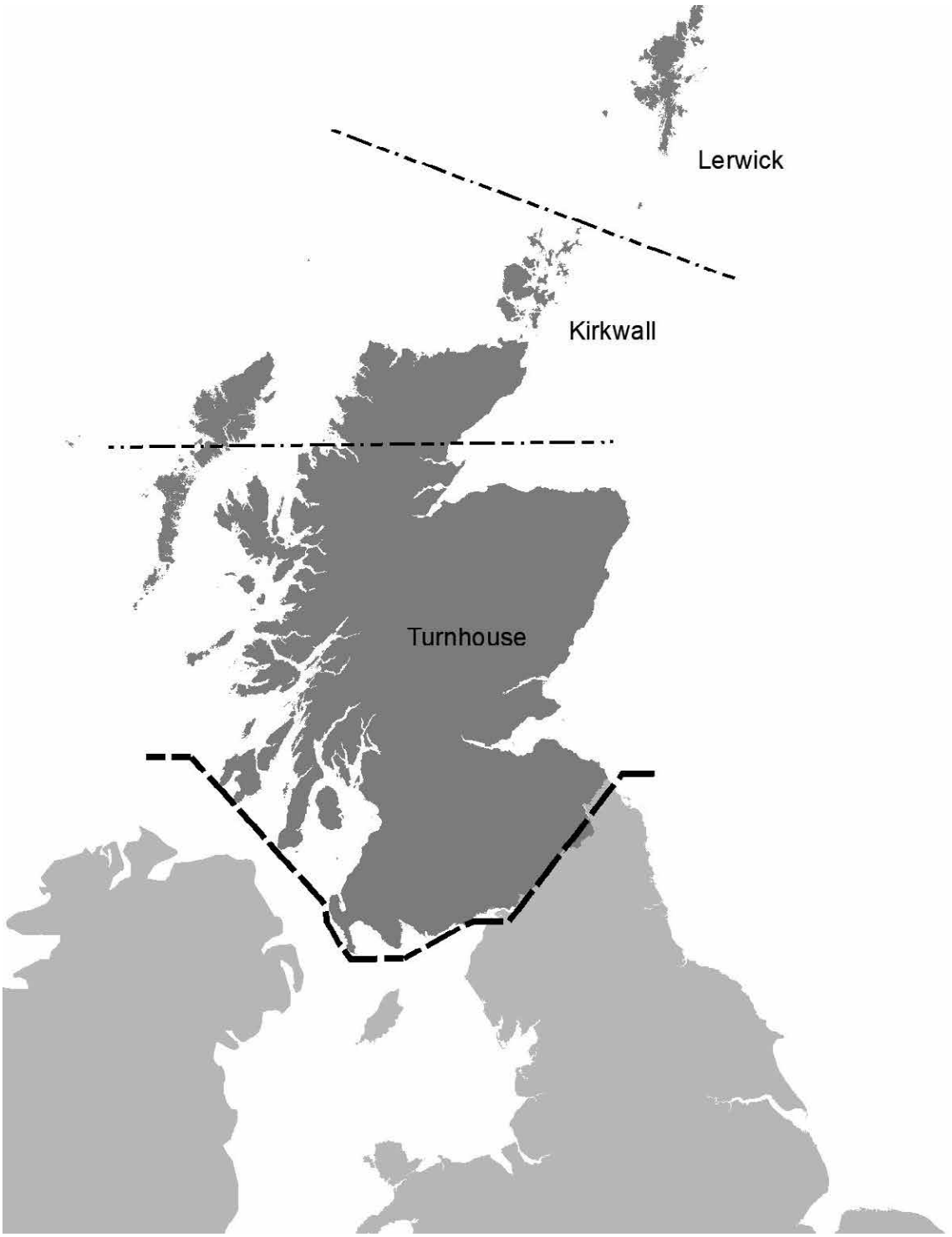

Observer Posts
18 WOU Posts
Observer Posts
Coastguard Watcher Post
Observer Posts
Observer Posts
18 WOU Posts
Observer Posts
Observer Posts
Inverness Observer Centre
Aberdeen Observer Centre
Dundee Observer Centre
Oban Observer Centre
Glasgow Observer Centre
Dunfermline Observer Centre
Filter Room
Operations Room
14 Group HQ Inverness
Operations Room
Turnhouse Fighter Sector HQ
Radar stations
Radar stations
Operations Room
Triangulation Room
Peterhead Fighter Sector HQ
Fighters
Cocklaw CHL radar
VHF Fixer Stations
Fighters
Operations Room
Triangulation Room
Tain Fighter Sector HQ
Aberdeen GOR
AA gunsites
AA gunsites
Lossiemouth GOR
VHF Fixer Stations
AA gunsites
Kinloss GOR
AA gunsites
Invergordon GOR
Sub-Filter Room
Operations Room
Triangulation Room
Tiree Fighter Sector HQ
AA gunsites
Oban GOR
VHF Fixer Stations
AA gunsites
Fort William GOR
AA gunsites
Kyle of Lochalsh GOR



10 Royal Air Force Fighter Command No 13 Group and Sectors, July 1943 (© Historic Environment Scotland).



11 Royal Air Force Fighter Command No 13 Group and Sectors, June 1944 (© Historic Environment Scotland).



12 Royal Air Force Fighter Command No 13 Group and Sectors, April 1945 (© Historic Environment Scotland).

(GDA) (TNA, AIR 10/4040). There were three classes of GOR: Class 'A' were GORs housed within RAF Group or Sector Operations Rooms; Class 'B' were GORs for GDAs where the defences exceeded two Heavy Anti-Aircraft gun sites and one Light Anti-Aircraft Troop HQ; and Class 'C' were GORs at airfields at which the AADC did not receive any information from a Group or Sector Ops Room (TNA, WO 166/2213). Most GORs were located in requisitioned properties, although some (Clyde, Forth, Loch Ewe and Stranraer) were eventually housed in purpose-built protected buildings to drawings prepared by the Chief Engineer at Scottish Command (TNA, WO 166/7369).

The functions of the GOR were as follows:

a. To constitute the battle headquarters of the Anti-Aircraft Defence Commander from which he was able to control the fire of the defences.
b. To assist gun positions in their task of engaging hostile aircraft by passing to them all possible information about the movements of hostile, doubtful and friendly aircraft.
c. To receive information from gun positions about height, location and course of hostile aircraft and pass this information to RAF Group and Sector Operations Rooms.
d. To give intelligence information to Headquarters, AA formations.
e. In certain defended areas, to pass information on movements of hostile, doubtful and friendly aircraft to other sources such as balloon barrage centres, units of the Royal Navy and Commanders Fixed Defences (TNA, WO 166/2129).

At the outbreak of war in September 1939 there were only two GORs in Scotland: Forth (located at 8 Wemyss Place, Edinburgh) and Clyde (at 27 West George Street, Glasgow) (TNA, WO 166/2127). Although the standard procedure was for information to be passed from Group and Sector Operations Rooms, in the case of Forth and Clyde GORs, both received information on movements of all aircraft from Turnhouse Sector Operations Room only (TNA, WO 166/2129). As the number of Vulnerable Points across Scotland that required AA defence increased, so did the number of GDAs and GORs. Unsurprisingly, the next to open was Scapa GOR in February 1940, controlling the AA guns protecting the Home Fleet base (TNA, WO 166/1234). Soon afterwards a GOR opened at Ardeer, to protect the huge ICI munitions factory there, with other GORs opening in 1940, at Aberdeen, Castletown, Dundee, Invergordon, Kinloss, Kyle of Lochalsh and Lossiemouth (TNA, WO 166/2129). Shetland GOR opened in Lerwick in 1941 (EV Adcock, pers comm) and the remaining GORs in Scotland opened in early 1942, including Inverkip, Loch Ewe, Oban, Reiss, Stornoway and Stranraer (TNA, WO 212/81). In addition, several Sub-GORs opened in 1942, supporting their parent GOR although these were mostly very short-lived, only operational for a few months (TNA, WO 166/7309, WO 166/7399, WO 166/11216). As with Fighter Sector Headquarters, Gun Operations Rooms reached their peak in 1942 and it appears that it was during late 1942 when

GORs were officially re-designated as Anti-Aircraft Operations Rooms (AAORs) (TNA, WO 212/81), although the term GOR remained in widespread use until the end of the war.

Most of the Sub-GORs closed in late 1942 or into 1943 (TNA, WO 166/7309; WO 166/11216). Of the main GORs, Loch Ewe probably closed in 1943 (TNA, WO 166/11169), Dundee closed in April 1944 (TNA, WO 166/14650) and Aberdeen was downgraded in August 1944 (TNA, WO 166/14638) and closed in 1945. Forth closed in April 1945 (TNA, WO 166/16650) and Clyde almost certainly closed down around the same time. Most of the others (Ardeer, Inverkip, Invergordon, Kinloss, Kyle of Lochalsh, Lossiemouth, Oban, Reiss, Scapa, Shetland, Stornoway and Stranraer) probably closed in 1945, although no evidence has been found to confirm exact closure dates.

The role of the GOR in the air defence system has been almost completely overlooked in literature about the air defence system in the UK but played a central role in directing anti-aircraft gunfire. This gunfire was responsible for the destruction of 822 enemy aircraft, probably destroyed another 237 and damaged a further 422 across the UK during the Second World War (Pile, 1949: 397). Separate figures for Scotland are, sadly, not available. Although the fighter aircraft of the Royal Air Force often get the greatest credit for the air defences, anti-aircraft guns, and the GORs that directed them, also played a very important part in those defences.

It is clear that the organisation of the air defence system in Scotland between 1938 and 1946 was significantly more complex than has previously been recognised. The simplified version, that radar stations passed plots to the filter room at Fighter Command Headquarters and this filtered information, along with Observer Corps plots was passed to Group and Sector Operations Rooms, massively underplays the complexity of the system. In Scotland, there was major devolvement of reporting and control with the creation of the filter room and FSHQ at Wick. This lay outside the simplified structure of the UK air defence system as generally accepted in even the official histories (Collier, 1957). The fact that the main Home Fleet base had its own separate air defence system until 1941 indicates not that it was unimportant but rather the lack of available resources and the desperate need to provide some form of effective early warning and air defence.

The success of the air defence system in Scotland lay not with its individual components but rather in the way these components were connected into an integrated whole. Detecting and identifying approaching aircraft, and the communication of this information for filtering and then to operations rooms for appropriate action, required several important elements to make the system work effectively. The filtering of aircraft plots was a complex process that required great skill and understanding to produce accurate results rapidly, whilst the information was still current. The work of the Movement Liaison Organisation was also vital, creating and communicating records of the movements of friendly aircraft and thereby separating these from hostile plots. However, perhaps the most important element of the entire system was the extensive communications

13 Gun Operations Rooms in Scotland during the Second World War (© Historic Environment Scotland).

network that allowed for the rapid and mostly secure transmission of this information between the various operations rooms. This expanded significantly between 1938 and 1946 and required a massive effort, mostly from engineers and linesmen of the Post Office, to facilitate the expansion of the air defence system.

Chapter 2

Filtering and Plotting Aircraft

The purpose of the filter room was the co-ordination of information on aircraft movements received from radar stations and other sources, and the onward transmission of filtered information to Operations Rooms (HRA, Royal Air Force Filter Room Standing Orders).

Joan Clarke (Crawford) was a Filter Room Plotter at Bentley Priory from December 1939 and describes the filtering process:

> *In front of me, illuminated from above by strong lights, was a very large table map of the British Isles showing the location of all coastal radar stations and at each position was a telephone socket … which had a direct line to that station. The map was formed in the shape of a giant letter 'J' because it followed the shape of Britain's coastline stretching from Scotland, right down the eastern side and turning round the south. There was not much land shown, our stations at the coast showed only activity over the sea and into the countries beyond; when aircraft passed inland behind them, we finished plotting … Stations were generally quite close to each other and so, to make space for us to work, plotters were arranged on both sides of the map, some working towards themselves, others away; roughly about twelve or fifteen on one side and eight on the other. A grid was marked over the whole map, the bigger squares being something like three feet (picture, if you can, large graph paper) and these were further divided into ten lines horizontally and vertically and numbered one to ten; further divisions of the grid were not marked and had to be calculated by eye. Each large square had a letter of the alphabet marked in the centre to distinguish it from the next, and each side of the square represented 100 kilometres. A plot would come through from Ventnor and I would place a counter at that point on the map. The counters, which we unofficially called 'Tiddlywinks', were about the size of a new one penny coin and were the colour associated with your particular station; Ventnor was orange and Poling, next to me, I think was blue. These we placed by hand, unlike the Operations Room who placed plots with long rods. Fanning out*

seawards at range gradations of 20 miles, using the station as a centre point, arcs were drawn and individually numbered 10-20-30, etc, as the distance from the station increased, up to 180 miles.

The system worked efficiently but, in totally relying on the human factor, only a small plotting error could result in our pilots being given wrong information and missing an interception. Roughly speaking, it worked like this. At each station on the coast the readings from their radar screen were converted into map reference 'plots' and shown on a small table map which geographically covered the area watched by the station. The grid of this map was exactly the same scale as ours and plots of approaching aircraft were 'told' or read from it to me in the Filter Room. I placed counters on the given points. WAAFs with stations on each side of mine would be plotting at the same rate with their stations locating the same raid, but obviously they would be recording things from a different position along the coast and the ranges would be different; if we were getting it right, most of the counters would fall near to each other and clear track could be seen emerging. Beside us stood an Officer Filterer watching the table very carefully and, as soon as the counters began to take the form of a track, he put down a plastic arrow at its head to show the direction in which it was moving and where he calculated, from the trail of coloured counters, the aircraft would be (later he placed an arrow after the first plot so that time was not lost waiting for a track to form). If one station's plots were inconsistent, he would tell the plotter to ask the station to check their sendings. The track continued; after several more counters another arrow was placed, and so on. Counters were removed after 2½ minutes.

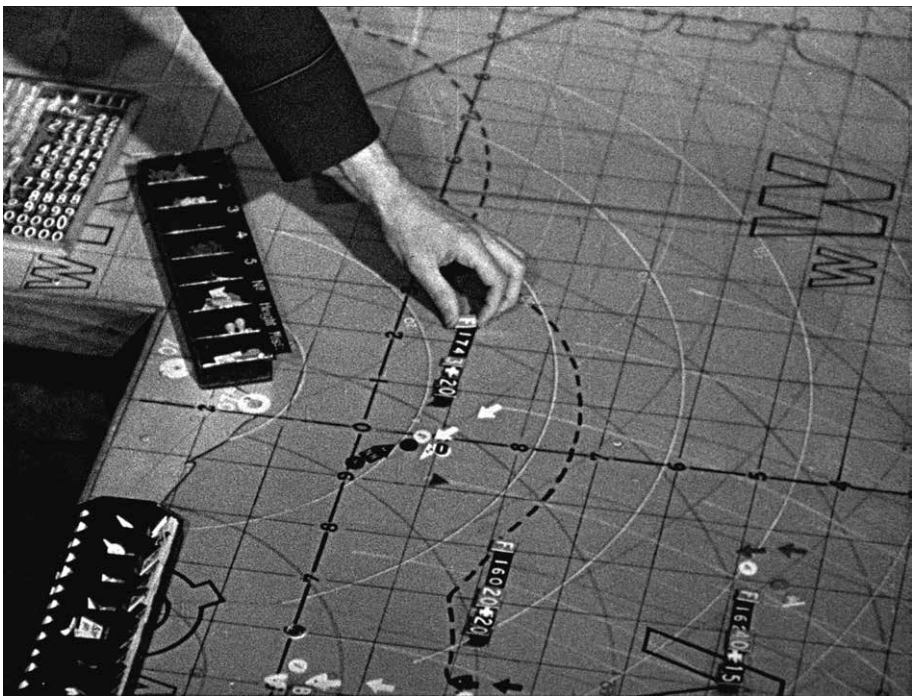
The Filterer's job was a very difficult one. The radar plots we received from the stations as a single grid reference were made up of readings of 'range', that is to say the distance the aircraft were from the station, and 'bearing' which was, roughly speaking the angle made between the aircraft, the station and True North; all of this being calculated from the display on the station's cathode ray tube. This gave the position on the map. Their recording of range was accurate, those of bearing were less so and it was on the former, the range readings, that work was concentrated. The Filterer watched each plot's relative position to the range arcs on the table map and compared one station's output with that of its neighbours. For example, if my station was assessing aircraft to be on the line of the arc at 80 miles and the one next to me at, say, 60 miles, where our arcs crossed on the map at these ranges is where the aircraft would be. Usually, he would similarly be using the plots of another neighbouring station which was also helping to form the track. It was not quite as simple as this, however, because he had to calculate by eye the unmarked distances between the ten-mile spacings of the arcs and by using a rule of thumb method make a decision where to place his arrow. He also calculated a mean reading of the height and number of aircraft from information received from these stations. Sometimes our area had several tracks being worked on simultaneously.

As a track began to develop, a Raid Orderly nearby made up a 'raid plaque' by fitting magnetic numbers and figures on to a small tray. This was placed at, and moved with, the head of the track. It showed the given track number, the estimated number of aircraft and their height, also whether the raid was hostile, friendly, or 'X' unidentified. Later Radar Operators could see on their screen whether the aircraft carried IFF (Identification Friend or Foe), a device fitted to our aircraft which altered the shape of the blip, but until then movements liaison officers, watching the table from the balcony, and who had advance knowledge of the expected location of their respective Bomber and Coastal Command aircraft, identified their aircraft by shining a light producing a bomb or anchor silhouette on to the table below.

On the balcony watching the table sat the Filter Officer who controlled the working of the table and was responsible for the efficiency of the reporting of the entire radar chain. Three 'tellers' with headsets were also up there. Over direct telephone lines they read off the position of the arrow points, and other information showing on the plaques to waiting Operations Rooms in their area. The arrow points were now the 'true' plots. WAAF Recorders wrote down all those broadcast from the Filter Room to their Operations Room listeners so that they could be scrutinised later. A small PBX exchange took care of the numerous telephones up there, and the Filter Officer could speak on the phone to every radar station or anyone he wished to discuss or query anything with.

Measurement of speed was calculated by a WAAF who stood beside you using a stop watch, She could see the number of miles being covered by the aircraft and, by measuring the amount of time taken, could work it out; this was of some help to the Operations Room. Scientific Observers often came in to make checks on how things were going. When the bombing really got going in August [1940], *the number of raids increased daily and by September they were coming over in droves; it was quite terrifying; we knew how few we had. As the Battle of Britain developed, the increased tempo in the Filter Room could be measured by the increase in noise. I was receiving plots normally at 20 second intervals but often as fast as speed would allow; the voice speaking to me from the radar station never seemed to stop for breath* (Flint, 1996: 120-123).

As Joan Clarke describes, the process of filtering began with the Plotter, the person at the filter table who was in direct communication with individual radar stations. Plotters were arranged around the filter table in such a way as to have a maximum reach of 4 feet 3 inches over the area covered by their respective radar stations. Upon receiving a plot from a radar station, the Plotter would place a counter on the table corresponding to the four-figure grid reference given by the radar station. Each radar station was allocated a colour and the counters were coloured to match the corresponding radar station. Thus all plots from individual radar stations were in the same colour. The counter was also marked with dots or a number, corresponding to the 5-number indicator showing in the filter room at



14 A still from the film *The Scope and Purpose of the Filter Room* showing the filter table with plotting counters, raid plaque and different coloured range arcs from radar stations (© Imperial War Museum London AMY 157).

the time the information was received. This indicator changed every 30 seconds, and each numbered counter would be removed when the corresponding number reappeared. This ensured that no counter on the filter table was more than 2½ minutes old. Chain Home radar stations used numbers indicated by dots and Chain Home Low radar stations used Arabic numerals (HRA, Royal Air Force Filter Room Standing Orders).

The number of aircraft in the formation was indicated in a triangular counter and the height by a square counter, placed beside the plotting counter. When the plotting counter was removed at the end of the 2½ minute period, so were the corresponding strength of aircraft and height counters (HRA, Royal Air Force Filter Room Standing Orders).

During quiet periods when no plots were received from radar stations, Plotters called up their stations every 15 minutes to check the telephone line. This was done when the Sector Clock entered the red segments. The duties of Plotters included informing their radar stations of the position of aircraft within the station area, whether or not they had been seen by the radar station. Plotters also informed the radar stations of the movements of any aircraft likely to enter their stations' areas. They also informed their radar stations of the identification of tracks immediately once this was displayed on the filter table (HRA, Royal Air Force Filter Room Standing Orders).

15 Another still from *The Scope and Purpose of the Filter Room*, showing filterers working on and across the filter table (© Imperial War Museum London AMY 157).

16 The Temporary Filter Room at Stanmore, showing the time indicator at top left, with the number 3 illuminated (© Crown Copyright Royal Air Force Museum).

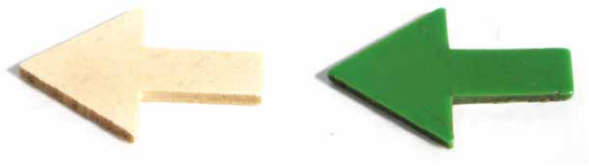
17 Chain Home radar station plotting counters (© Historical Radar Archive).

18 Chain Home Low radar station plotting counters (© Historical Radar Archive).

19 Strength of aircraft counters (© Historical Radar Archive).

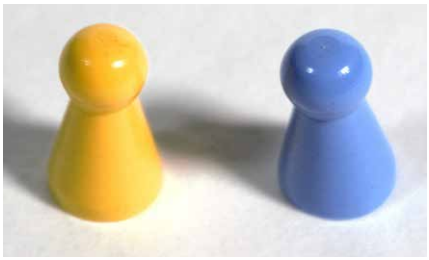
20 Height counters (© Historical Radar Archive).

It was the responsibility of the Filterer to accurately filter the information on the filter table. They had to make rapid assessments on the counters to determine what they considered to be the true position and course of the aircraft. They would then place an arrow, indicating the course of the aircraft by the direction in which the arrow pointed, and the location by the tip of the arrow. The corresponding grid reference at the arrow tip became the true position of the aircraft, and established a track, with a raid plaque being placed at the head of the



21 Filter arrows (© Historical Radar Archive).

22 Raid plaque, in this example for X462 (unidentified raid number 462) comprising four aircraft at an altitude of 17,000 feet (© Historical Radar Archive).



23 Halmas (© Historical Radar Archive).

track. The colour of the arrow was chosen so that adjacent tracks were of clearly different colours, thereby avoiding tracks being confused with each other. The arrow colours were also chosen to differ from that of the counters used in plotting the track, ie the filter arrows were different to the colours of the respective radar station plotting counters placed on the table by the Plotters (HRA, Royal Air Force Filter Room Standing Orders).

Any plotting counters which, in the opinion of the Filterer, were not part of the track were marked with a Halma game piece, coloured in accordance with the Colour-code Indicator. This was used to assist Filterers in remembering plots which would be removed when a track was established but otherwise remained until the repeat colour-change (HRA, Royal Air Force Filter Room Standing Orders).

Each radar station was marked on the map on the filter table, with range arcs in the station colour marked for every 10 miles. For Chain Home radar stations, the range of a plot was the most accurate measurement. Filterers were also knowledgeable about the radar chain, having an understanding of the different radars and their abilities and shortcomings, the relative performance of each station and any issues or inaccuracies. This knowledge was combined with the range arcs to help determine which plotting counters were most likely to be more accurate, and hence where the true position of the aircraft would be (Flint, 1996: 15, 121-122). Height information provided by radar stations was often less accurate and could

vary widely between adjacent stations. For example, to simply take the average between heights reported at 3,000 and 17,000 feet would not produce an accurate height of use for interception purposes. The filterer had to decide which of the two was more likely to be correct, taking into account the range and bearing at which the readings were taken by each individual radar station and assess which station had the better chance to being accurate (Air Ministry, 1952: 37).

The work of the Filterer was complex, time-critical and high-pressure. All the above calculations had to be done mentally at high speed. It was vital that the track was accurately determined, so that fighters would be directed correctly to intercept, and therefore that time was taken to calculate the correct position and course of the raid. However, it was also essential to do so as early as possible, as the greater the delay, the less time fighters would have to take-off and climb to height. This contradiction made the role difficult, with the added pressure of the knowledge that any errors or delays in the information passed to operations rooms could cost lives (Flint, 1996: 121-122).

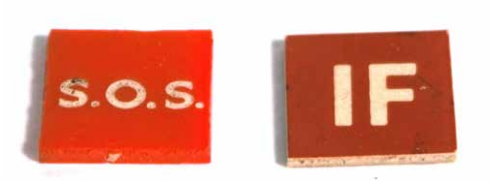
Each track was given a raid designation, with a prefix to identify the nature of the aircraft, as follows:

H Hostile/Hostile bombers
Z Hostile fighters
X Unidentified
F Friendly fighter
B Friendly bomber
K Friendly Coastal Command
N Friendly Fleet Air Arm
L Friendly Training
A Friendly Army Co-operation
R Friendly Photo Reconnaissance
C Friendly Civil
Q Radar plots believed to not be aircraft (TNA, AIR 10/4040).

The plaque identifying each track was made up by the Raid Orderly with counters showing raid number, strength of aircraft and height. This was then passed to the Filterer's Orderly, who was ready to hand the Filterer the plaques and identification counters required, as well as assisting the Filterer in removing tracks from the filter table (HRA, Royal Air Force Filter Room Standing Orders).

Prioritisation was given in filtering, in the following order:

1. enemy and doubtful tracks approaching the coast
2. new tracks
3. tracks displaying SOS
4. other enemy and doubtful aircraft
5. friendly fighter tracks
6. incoming friendly bombers, photo reconnaissance and Coast Command aircraft
7. incoming civil, Army Co-operation, Naval and training aircraft (HRA, Royal Air Force Filter Room Standing Orders).



24 Broad IFF and Normal IFF counters for CH radar stations (© Historical Radar Archive).

25 Broad IFF and Normal IFF counters for CHL radar stations (© Historical Radar Archive).

26 Drawing of a Raid Block, in this case for Hostile 686, comprising two aircraft at 18,000 feet, with one Flight from No 161 Squadron ordered to intercept (TNA, AIR 10/4040).

27 Sector Clock (© Bentley Priory Museum).

28 Sector Clock, with 2½-minute rather than 5-minute sectors. These clocks were mainly used by the Royal Observer Corps (museum number EF.1992.95.34 © Trustees of National Museums Scotland).

29 WAAFs LACW R Davie, LACW M Kidson and LACW Joan Wylie at the plotting table in Peterhead Sector Operations Room in 1944 (© Imperial War Museum London CH11882).

Aircraft in distress would send a Broad IFF (BIF) signal, indicating that they required assistance. Narrow IFF (NIF) was the signal identifying a friendly aircraft. Upon receiving NIF or BIF from a radar station, the Plotter would place a counter and immediately notify the Filterer. Once satisfied that BIF was being read by the radar station, the Filter Officer would order the Plotter to replace the BIF counter with an SOS counter. Special attention was given to tracks showing distress counters and priority of information regarding such tracks was requested from radar stations (HRA, Royal Air Force Filter Room Standing Orders).

Having established a track, this became the filtered or true plot and was immediately telephoned by the Teller from the filter room through to Fighter Command, Group and Sector Operations Rooms. Once passed to operations rooms, the format of plotting changed. The track was plotted by arrows, matching the grid references being told from the filter room. However, the colour of the arrow was not that of the radar station providing the plot, but rather was the colour indicated by the Sector Clock. This had the face marked with red, yellow and blue segments, each lasting five minutes. At each colour change all previous arrows of the new colour were removed, thus ensuring that information on the operations room table was no more than 15 minutes old. Alongside the most recent arrow was placed a Raid Block, which displayed the raid number, number of aircraft and height (TNA AIR 10/4040).

Unlike the filter room, Operations Room Plotters did not place counters and other information on the table by hand, but used a rod with a battery-operated

magnetic tip. When the Plotter received information from the Filter Room Teller, they would pick up an arrow in the correct colour as indicated by the Sector Clock and place it on the table in front of them. They picked it up on the end of the rod by activating the magnet, then placed it on the map with the tip of the arrow at the given grid reference, and released it. The raid plaques, with details of raid designation, strength of aircraft and height, were not magnetic and these were positioned at the head of the track and moved using a small stick (Flint, 1996: 125-126). This information appeared in Fighter Command Operations Room, Fighter Group Operations Rooms and Fighter Sector Operations Rooms simultaneously and was used for the strategic direction and tactical control of fighter aircraft across the air defence system. This information was also communicated to Anti-Aircraft Gun Operations Rooms.

Chapter 3

Movement Liaison Organisation and tracking friendly aircraft

The primary function of the Movement Liaison Organisation was to provide filter rooms with sufficient information about the movements of friendly aircraft to enable these tracks to be identified on the filter table. Additional functions were to provide advance warning of impending movements of friendly aircraft to ground and air defences (including Anti-Aircraft Gun Operations Rooms); to assist Flying Control Liaison Officers at Fighter Group Headquarters with respect to aircraft believed to be in distress; to liaise between the reporting system and units operating aircraft; and to liaise between the MF D/F systems and units operating aircraft (HRA, SD 564 A Memorandum Produced by Headquarters Fighter Command on the Raid Reporting and Control Aspects of the United Kingdom Air Defence Organisation, November 1945).

A Movement Liaison Section was established in each filter room, and a comprehensive system of telephone communications made it possible for every flying unit in the UK to notify aircraft movements when necessary to a filter room. Air Ministry document SD 158 outlined the requirements for the notification of aircraft movements over or near the UK for defence purposes. Until late in the war, all flights over the sea were notifiable. When notification was required, the unit responsible for the flight communicated an aircraft movement notification to the relevant MLS. This was then prepared as an aircraft movement message and allocated a reference number to it. This message was then distributed to all Movement Liaison Sections in the filter rooms where the track of the aircraft was likely to be seen. Each MLS passed the appropriate information to the ground and air defences within its own filter room area (HRA, SD 564 A Memorandum Produced by Headquarters Fighter Command on the Raid Reporting and Control Aspects of the United Kingdom Air Defence Organisation, November 1945).

Movement Liaison Sections were often able to supply Flying Control Liaison Officers with details (such as W/T call sign, base and parent unit) of aircraft in distress that were being tracked by radar. They were also able to supply any valuable information received by the MLS from MF D/F stations (HRA, SD 564 A

Memorandum Produced by Headquarters Fighter Command on the Raid Reporting and Control Aspects of the United Kingdom Air Defence Organisation, November 1945).

Each filter room had an MLS, headed by a Movements Officer, and received particulars of all flights of aircraft within the area covered by the filter room. Courses, times, heights and quantities of friendly aircraft were therefore known and the tracks of these aircraft on the filter table could therefore be identified, whether the aircraft was showing IFF or not (TNA, AIR 10/4040).

Communications in the air defence system of Fighter Command were primarily of the point-to-point type, due to the vital nature of the messages passed over these lines. Access to circuits of lesser importance was made via the operations PBX. Probably the most important 65-line PBX switchboard was that serving the MLS. Circuits connected via numerous switching points to all other flying Commands, over which were reported in advance the proposed movements of aircraft belonging to those Commands, were terminated on the MLS switchboards at all Fighter Group Headquarters. The type, number, height, course and calculated time of arrival in any particular area were reported and the information was passed to all Fighter Sectors concerned. To prevent German signals intelligence obtaining advance knowledge of proposed bombing raids, the transmission of all such circuits was scrambled, frequency changes being incorporated in the circuits at guarded points (Hanna, 112).

MF D/F Stations

Wireless direction finding (D/F) was used in the Royal Air Force from 1924 in the medium frequency (MF) band (Air Ministry, 1952: 9). Recommendations made in 1934 regarding the provision of MF D/F stations were completed by mid-1937, with an MF D/F safety service in place comprising nine stations across the UK, including an Adcock station at Leuchars operating on a frequency of 340 kilocycles per second (Air Ministry, 1956: 521).

In 1938 plans were drawn up for the absorption of these civilian MF D/F stations into the RAF upon the outbreak of war. The main intentions were to give Coastal Command a D/F service for General Reconnaissance squadrons working over the sea, an alternative service for Bomber Command aircraft in distress and to contribute towards the scheme for identification of friendly aircraft in conjunction with radar. Arrangements were made for the retention where possible, of the civilian operators on the outbreak of war (Air Ministry, 1956: 521).

Between 1939 and 1942 the MF D/F organisation, using Marconi DFG.10 ground equipment, was the most important of all radio aids to navigation. Operating at a frequency between 300 and 400 kilocycles per second, it had a range of around 350 miles for an aircraft at an altitude of 7,000 to 8,000 feet (Air Ministry, 1956: 541).

The normal channel by which MF D/F control stations reported MF fixes and other MF information received from aircraft was by direct speech circuit to a Movement Liaison Section. The receiving MLS informed the appropriate Identification Officer of all MF bearings and fixes, the Group Flying Control

Liaison Officer of all information received from or about aircraft in distress, and the unit to which the aircraft belonged of all distress messages and of other special messages as required (HRA, SD 564 A Memorandum Produced by Headquarters Fighter Command on the Raid Reporting and Control Aspects of the United Kingdom Air Defence Organisation, November 1945).

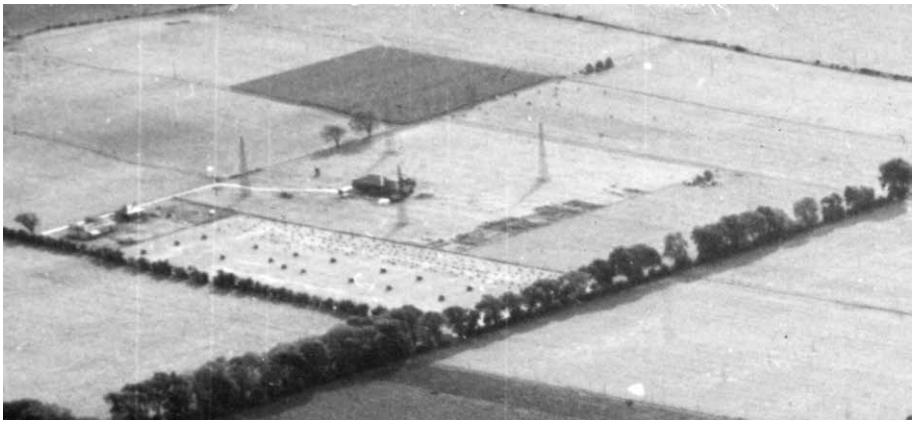
A degree of operational control of MF D/F transmissions was exercised by the respective MLS to which such stations were connected. Thus, in cases of aircraft of doubtful identity the MF D/F Control Stations referred to the MLS for authority to transmit; special messages could be transmitted to particular aircraft at the request of their parent unit made to the MF D/F Control Station through the MLS; and in collaboration with the Group Flying Control Liaison Section, the MLS was able on occasions to have appropriate courses to steer transmitted by the MF D/F stations to aircraft in distress (HRA, SD 564 A Memorandum Produced by Headquarters Fighter Command on the Raid Reporting and Control Aspects of the United Kingdom Air Defence Organisation, November 1945).

At the beginning of the Second World War, the MF D/F service had an important function separate from providing direction finding assistance to aircraft: identification of friendly aircraft crossing the UK coast. Aircraft returning from operations called the control station of its MF identification section and sent its movement serial indicator. This enabled the position of the aircraft to be fixed and its identity verified. Later in the war, aircraft relied on call-signs only, instead of the movement serial indicator; the call-signs were entered on the appropriate pre-flight documents and the information was forwarded to the D/F stations concerned. The fix was passed to the filter room where it was compared with radar information and thereby identify as friendly otherwise unidentified radar plots (Air Ministry, 1956: 542).

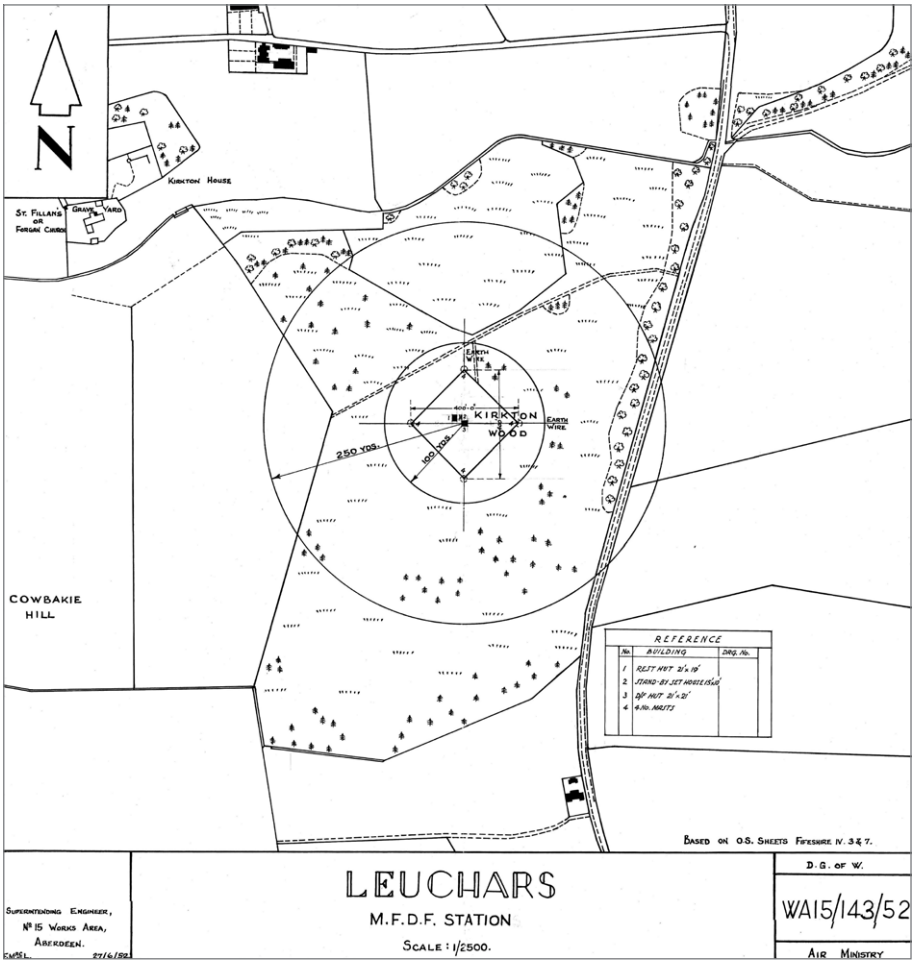
MF D/F stations operated in sections, with one station acting as section control, and landline communications between the stations was used to pass bearings to control. Lines were placed underground within 350 – 400 yards of the D/F station (Air Ministry, 1958: 34). By 1941, MF D/F stations were located in Scotland as follows: Section A: Inverness (Control Station), Sumburgh, Kirkwall; Section B: Renfrew (Control Station), Stornoway, Belfast (Comber) in Northern Ireland; Section F: Sealand in Wales (Control Station), Andover in Hampshire, Leuchars; Section O: Leuchars (Control Station), Wick and Carlisle in Cumbria (TNA, AIR 10/2758). Sections A and B, although primarily intended for use by Coastal Command were also used by Bomber Command in emergencies. Section F was one of four reserved for identification and for D/F fixes in emergencies only (Air Ministry, 1956: 542).

MF D/F Stations

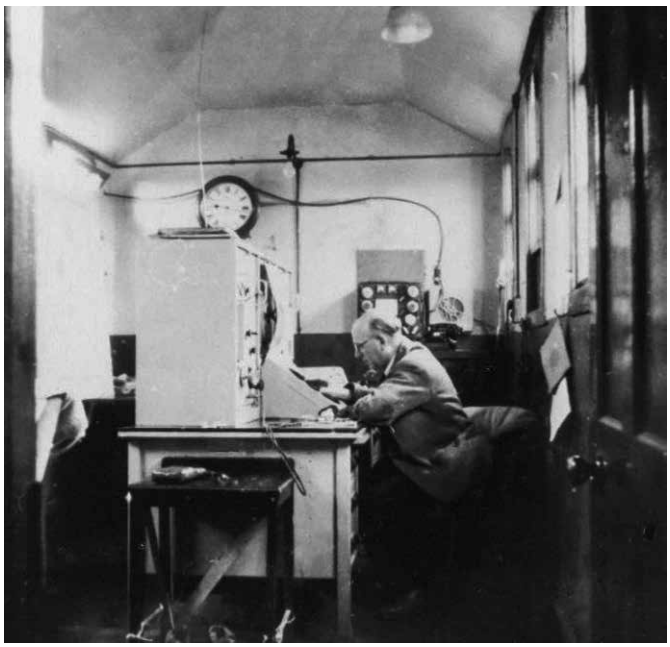
Sumburgh (Ward Hill)	HU 3938 1265
Kirkwall (Warrenfield)	HY 4573 0990
Wick (Reiss)	ND 3307 5553
Inverness (Dellfield)	NH 6866 4410
Stornoway (Maybury)	NB 4423 3288
Renfrew (Houston Road)	NS 4624 6795
Leuchars (Kirkton Wood)	NO 4498 2572



30 Aerial view of Inverness MF D/F station, taken in October 1942 (© Historic Environment Scotland).



31 Plan of Leuchars MF D/F station (© Historical Radar Archive).

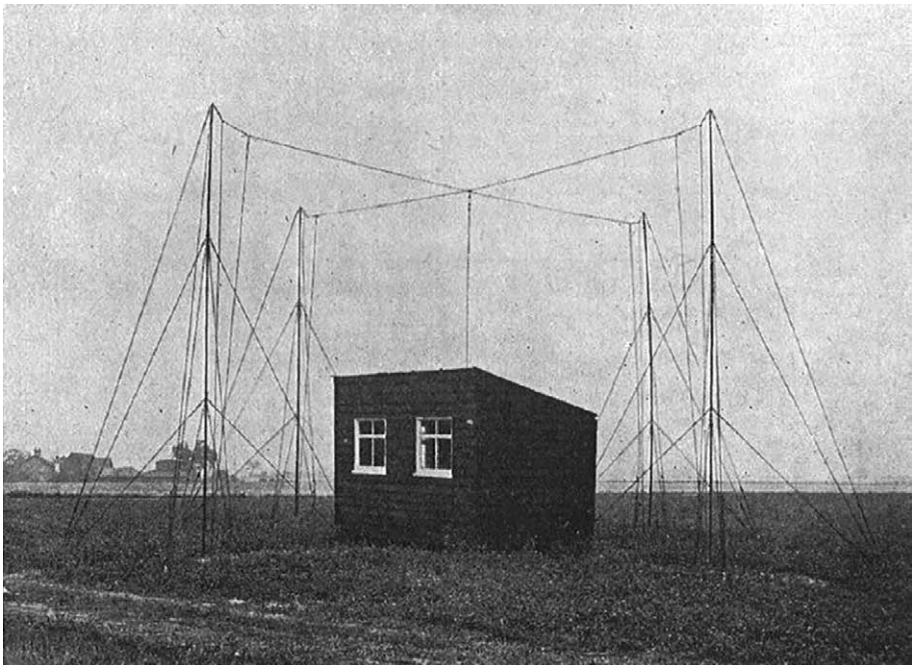


32 Inside Sumburgh MF D/F station (via Gordon Carle).

HF and VHF D/F Stations

In January 1935 trials successfully showed that D/F was possible in the high frequency band used by the standard fighter radio set, the TR9. In March 1936 it was decided that HF D/F stations should be sited at all sector airfields for homing purposes but it was only in late 1936 that D/F stations were used for fixing, ie establishing the location of friendly aircraft (Air Ministry, 1952: 9-11, 14). Three HF D/F stations were provided per sector, one located in the vicinity of the sector station, and the other two 30 – 40 miles forward of the sector station. All three HF D/F stations were connected to the sector station by landline (Air Ministry, 1958: 35).

In order for the D/F stations to work, one fighter in a formation had to transmit continuously. However, in 1938 a new version of the radio equipment was developed with two frequency channels, one for operational R/T and the other for D/F. This set was the TR9D. Experimentation demonstrated that a D/F station could get an accurate bearing on an aircraft from a signal of only 14 seconds duration. This allowed four aircraft in a formation to send a D/F signal every minute, with a one second interval between transmissions. This initially required accurate use of stopwatches in the cockpits but took too much of a pilot's attention. Instead, an automatic time-switch known as a master contactor was devised and incorporated with the TR9D. The master contactor was clockwork driven and produced a 1,000 cycles per second note in the pilot's headphones during the D/F transmission. For this reason, it became known as 'pipsqueak'. The remote control contained a dial with a moving pointer which told the pilot when the 14 second D/F transmission was taking place, thereby allowing him to avoid that part of each minute for R/T transmissions (Air Ministry, 1952: 17-18).



33 Typical HF D/F station (© Historical Radar Archive).

There were, however, problems with HF radio. The range of the TR9 set was too short and its performance too variable for efficient air-to-ground communication. The short range possible for D/F fixing restricted the area over which fighter aircraft could be positioned (Air Ministry, 1952: 42). Development of VHF R/T had been ongoing at the Royal Aircraft Establishment since 1935 but it was not until October 1939 that service trials began with six Supermarine Spitfires of No 66 Squadron based at Duxford in Cambridgeshire (Air Ministry, 1952: 43-44). Due to delays in the production of TR1133 VHF radios, the roll-out of VHF to Fighter Command was postponed in May 1940 and all aircraft already equipped had their sets replaced with the HF TR9D (Air Ministry, 1952: 45). As production improved, it was decided in August 1940 to restart the replacement of HF with VHF radios and by the end of September 1940 16 day fighter squadrons had been fitted with VHF sets (Air Ministry, 1952: 49).

HF D/F stations were installed at Fighter Command Sector Stations from 1936 onwards. By that time, the early experimental Chandler-Adcock system of a rotating aerial formed by two aluminium plates mounted on a vertical spindle and connected to a modified receiver had been replaced by the Marconi type (Air Ministry, 1952: 9-10), using the Marconi DFG.12 housed in a wooden hut measuring 10 feet by 10 feet in the centre of four masts (Air Ministry, 1956: 513). Turnhouse, as the only pre-war Sector Station in Scotland, was equipped with three HF D/F stations, construction of which started in the spring of 1939 and was due to be completed by August (TNA, AIR 2/1379). As per Fighter Command requirements one was sited at Turnhouse as the Sector Station and the others

elsewhere in the Sector, roughly equidistant from each other (Air Ministry, 1952: 15). These were at Kilrenny in Fife and Methven in Perthshire (TNA, AIR 2/5286).

Turnhouse Sector switched to VHF in late September 1940 (TNA, AIR 28/861). A further 41 squadrons and 17 Sector Stations had been re-equipped with VHF by the end of 1940 (Air Ministry, 1952: 54), with the remaining squadrons in Fighter Command changed over to VHF by March 1941 (Air Ministry, 1952: 54). Dyce Sector switched over to VHF in March 1941 (TNA, AIR 28/235), and Ouston moved onto VHF on 18 March 1941 (TNA, AIR 16/185). From 1941 onwards, following the general introduction of VHF R/T in Fighter Command, VHF D/F ground equipment replaced HF D/F (Air Ministry, 1956: 504). Following from this change-over, many of the Fighter Command HF D/F Fixer stations were transferred to other RAF Commands, to provide HF D/F facilities for their use (Air Ministry, 1958: 91).

There were different kinds of VHF D/F station: Homers and Fixers. Homers were located very near to airfields and a D/F bearing was taken on speech transmissions from the aircraft, from which directions were passed to the pilot to fly to reach the D/F station, Where the aircraft was at a height of at least 10,000 feet, VHF Homers had a range of up to 120 miles. In contrast, two or more Fixers provided bearings taken simultaneously on the same aircraft transmission. These were passed by telephone to the triangulation room at an FSHQ, providing a 'fix' of the aircraft's position. Generally, the 'fix' was not passed to the aircraft but rather a course plotted from the 'fix'. The maximum range for a reliable 'fix' was 80 miles for an aircraft flying at 10,000 feet (TNA, AIR 10/3701).

The original three VHF Fixer stations for Turnhouse Sector were Straiton (Fixer 'A'), Largoward (Fixer 'B') and Lamberton Moor (Fixer 'C') (TNA, AIR 2/8535). The huts for Straiton Fixer were ready for fitting on 3 July 1940, with Carnbee Fixer huts (moved to Largoward) ready for fitting on 20 July. The hutting for Cauldhame, Warthill, Shebster and Lyster Fixers in Kirkwall Sector was in transit as of 15 July (TNA, AIR 2/4495).

A VHF R/T test flight on 28 November 1940 from Drem to midway between Rathlin Island and Islay, noted that Largoward followed the aircraft throughout the flight but that stations at Lamberton Moor and Straiton could not make a fix beyond Arran. This led to a recommendation to provide a mobile VHF station at Prestwick to work with the Turnhouse Sector Fixers, which would provide sufficient facilities for reasonably safe operational flights in the Clyde and Glasgow areas (TNA, AIR 16/185).

In early March 1941 construction of Shebster and Lybster Fixer Stations was complete, and they had power houses but no diesel engines, this remaining the situation until the end of July when one diesel was despatched to each site. By 9 July 1941 plans to move Shebster to Strathy Point were abandoned as "first class results are already being obtained." On 30 May 1941, the other two Fixers in Kirkwall Sector, Cauldhame and Warthill had diesel engines but no wiring or power houses. (TNA, AIR 2/8535). On 5 June 1941 it was noted that the telephone lines from Shebster and Lybster to Kirkwall FSHQ had not been completed by the General Post Office. D8 wire was being used but was continually breaking down and the general quality of the communication with Kirkwall was poor. Estimates for

the completion of these lines had been given on 28 April as two weeks for Lybster and three weeks for Shebster. Due to these lines still not being completed in June, the GPO was being urged to complete them (TNA, AIR 2/7131).

The Fixer Station at Herscha Hill (Peterhead Sector Fixer 'E') was under test with a mobile VHF Fixer in June 1941 and mobile VHF Fixers were operating at Hill of Warse (Kirkwall Fixer 'E') and Upper Dysart (Peterhead Fixer 'D') from around July 1941, the latter probably the same mobile VHF Fixer that had been operating at Scurdie Ness from at least May 1941, to also operate as a VHF Homer for RAF Montrose. Upper Dysart was approved on 9 October 1941 and permission to proceed with construction of the permanent station was given on 2 November. The same day, approval was given for Cairn Hill (Peterhead Fixer 'F') as being operationally suitable. In contrast, Hill of Warse did not become a permanent station because it had only been used in the event of telephone line failure between Orkney and the Scottish Mainland and hence the provision of permanent facilities were not considered justified (TNA, AIR 2/8535).

On 24 March 1941 Air Marshal Sir William Sholto Douglas, Air Officer Commanding-in-Chief of Fighter Command, noted that, in regard to VHF Fixers in the Prestwick/Ayr Sector, the position at that time was that a mobile VHF Fixer was in use pending line provision to Ayr Sector Fixer 'D' at East Kirkbride, Kirkcolm (later established at Brough); the planned site for Fixer 'A' at Coillabus on Islay was not in use and awaiting telephone line provision. This site was considered really important as it was required to provide 'fixing' over the North Channel; Fixer 'C' at Prestwick was in use; Fixer 'B' at Rosneath north of Greenock proved to be impossible for a mobile D/F and consequently a mobile was in operation at that time at West Kilbride. However, that site gave poor fixing over Glasgow and none over the Clyde. An alternative site was requested but because the ability to 'fix' aircraft over Glasgow was considered very important, an alternative site covering Glasgow was found at Greenbank Farm near Carluke, and a mobile D/F was operating there. The GPO were requested to provide a telephone line to the site, which would become Hill Rig, Ayr Fixer 'E'. Greenock Fixer (Ayr Fixer 'B') was approved on 30 October 1941, having been tested using a mobile VHF Fixer, with construction of Pisgah (Ayr Fixer 'C') underway at that point and Brough (Ayr Fixer 'D') almost complete (TNA, AIR 2/8535).

Concerns were raised during 1941 about the possibility of interference to Fixer stations by balloon barrages. However, the Controller at Turnhouse stated that the balloon barrage cables had no detrimental effect on the Turnhouse Fixers (TNA, AIR 2/8535).

The construction of the VHF Fixer Station at Lybster was completed by the Air Ministry Works Directorate at Wick on 1 May 1942. The site consisted of an octagonal wooden D/F tower, a Rest Hut and a Stand-by Power House, with the latter containing two Blackstone Dorset engines and two 4.5 kilowatt alternators generating the electric power for the site. However, it was not until 17 July 1942 that a VHF fitting party began installing VHF equipment in the VHF D/F stations in Tain Sector. Lybster and Findochty Fixer stations were completed on 29 July and ready for calibration to be carried out (TNA, AIR 28/804).

During a visit to Lamberton Moor Fixer on 21 May 1942 FL Barkett of the Air Ministry Directorate of Telecommunications found that the entire D/F tower was lined inside with asbestos cement sheet. The same had been done to the Homing D/F tower for Charterhall. Instructions were issued to the local Superintending Engineer to have the asbestos lining removed at both stations. All Air Ministry Works Superintending Engineers were informed that under no circumstances were the top portions of any VHF D/F towers to be lined with asbestos sheeting, because this adversely affected the performance of the stations (TNA, AIR 2/4496).

Work on the construction of Hill Rig Fixer started on 5 April 1943, and was ready for the fitting party on 22 July. By 29 July, the tower was complete at Melvaig with the truncation of the towers from three storeys to two complete at Upper Dysart and Tullyfergus (TNA, AIR 2/4496).

George Hambling was an R/T Operator Direction Finding, with emphasis on VHF D/F and was posted to Tiree in 1942 as a Leading Aircraftman:

> *I was there for about 12 months. It sounded like a long way from home and I was not thrilled about going there … On Tiree we were attached to Coastal Command. I was stationed near Heanish, where I and two other Direction Finding Operators lived in a block hut and got our meals with Mrs MacDonald and Mrs MacKinnon. Mr 'Mac' was the lighthouse keeper … We operated a D/F tower adjacent to our hut … At Heanish we were somewhat 'out of sight, out of mind' of the main camps. We three operated a 24-hour watch system – always on duty. We did our job and looked after ourselves, doing our own washing and ironing. We had a stove in our hut for hot water and a chemical toilet that had to be emptied into a very big hole that we dug. All rather primitive really, but we were young and keen …*
>
> *I was keeping a very sharp ear out for any sort of sound on the air, when suddenly an American voice, very, very loud came through. "Hello Straw hat, are you receiving me?" (Straw hat was our call sign). I snapped a bearing on him. He replied "That's Okay guy, I can see you, out." I took off my headphones and looked out a window, in time to see a Flying Fortress fly right over and then touchdown. The story went around that he had flown direct from Newfoundland and was one of the first to come over direct. Previously the planes had come on ships but too many were lost that way to U-boats* (Hughes and Holliday, 2012: 63-64).

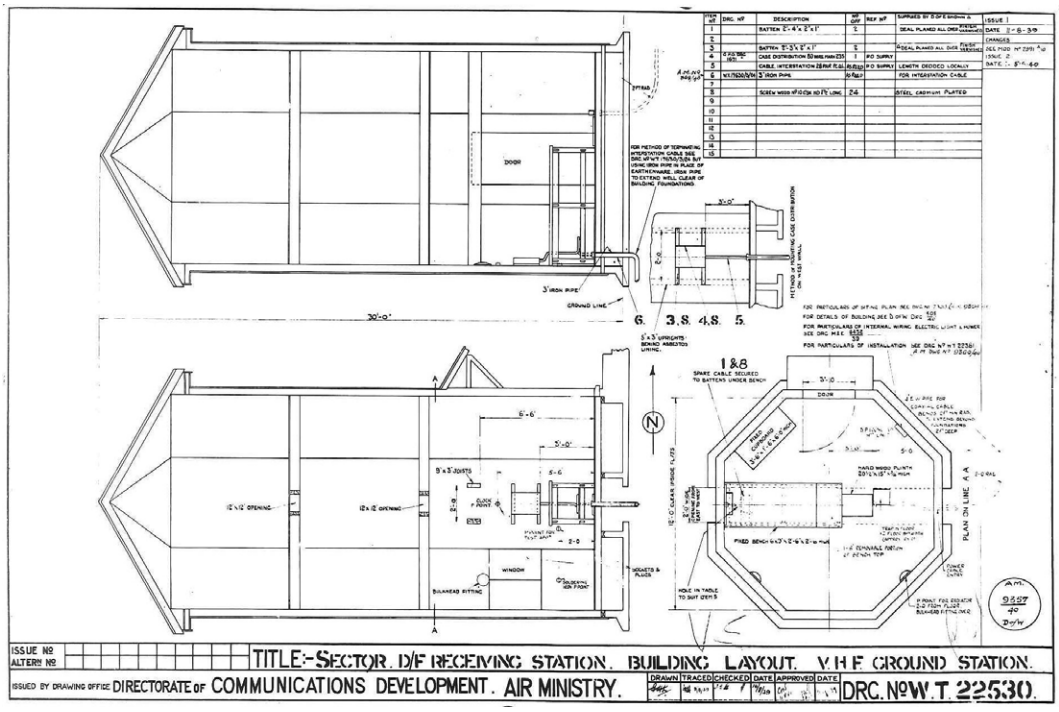
In 1944, a WAAF known as Vi was posted to Balthayock Fixer Station:

> *This was a time when the services were preparing for the 'D-Day' invasion and, where possible, women were replacing men. This D/F station was 'manned' entirely by women, three telephone operators and three Radio Telephone operators. They worked in pairs, one Radio Telephone operator and one telephone operator manning the station, two girls coping with the domestic side, cooking and cleaning, and two girls off duty.*

These girls came from widely diverse areas and backgrounds, but buckled down to work well as colleagues and, eventually, friends. They were billeted first in Westwood, the dower house of the estate, and then moved down into Balthayock House itself, but not into luxury. There was neither electricity nor gas in the billet. All cooking was done on a paraffin stove supplied by the RAF. Lighting was supplied by paraffin lamps. There was a coal and log-burning fire which helped with heating and cooking. There was usually a kettle or pot at the side of the hob …

The electricity to operate the station was supplied by two fearsome diesel engines. The girls felt that they were equal with the masculine world when they could operate them with confidence. They rigged up a field telephone for themselves from the billet to the station with material salvaged from the Errol station. All went well except that some cows in the field near the station, where the wire could neither be buried nor pinned out of reach, continually chewed at the wire, so frequent repairs had to be done (University of the Third Age Perth Branch, 1989: 27-28).

The domestic site at Hawthornside Fixer Station changed over from RAF personnel to WAAF on 27 June 1944, indicating that the Fixer Station was now staffed mainly, if not solely, by WAAF personnel (TNA, AIR 28/862).



34 Drawing of the standard VHF D/F or Fixer Station tower (via Imperial War Museums).

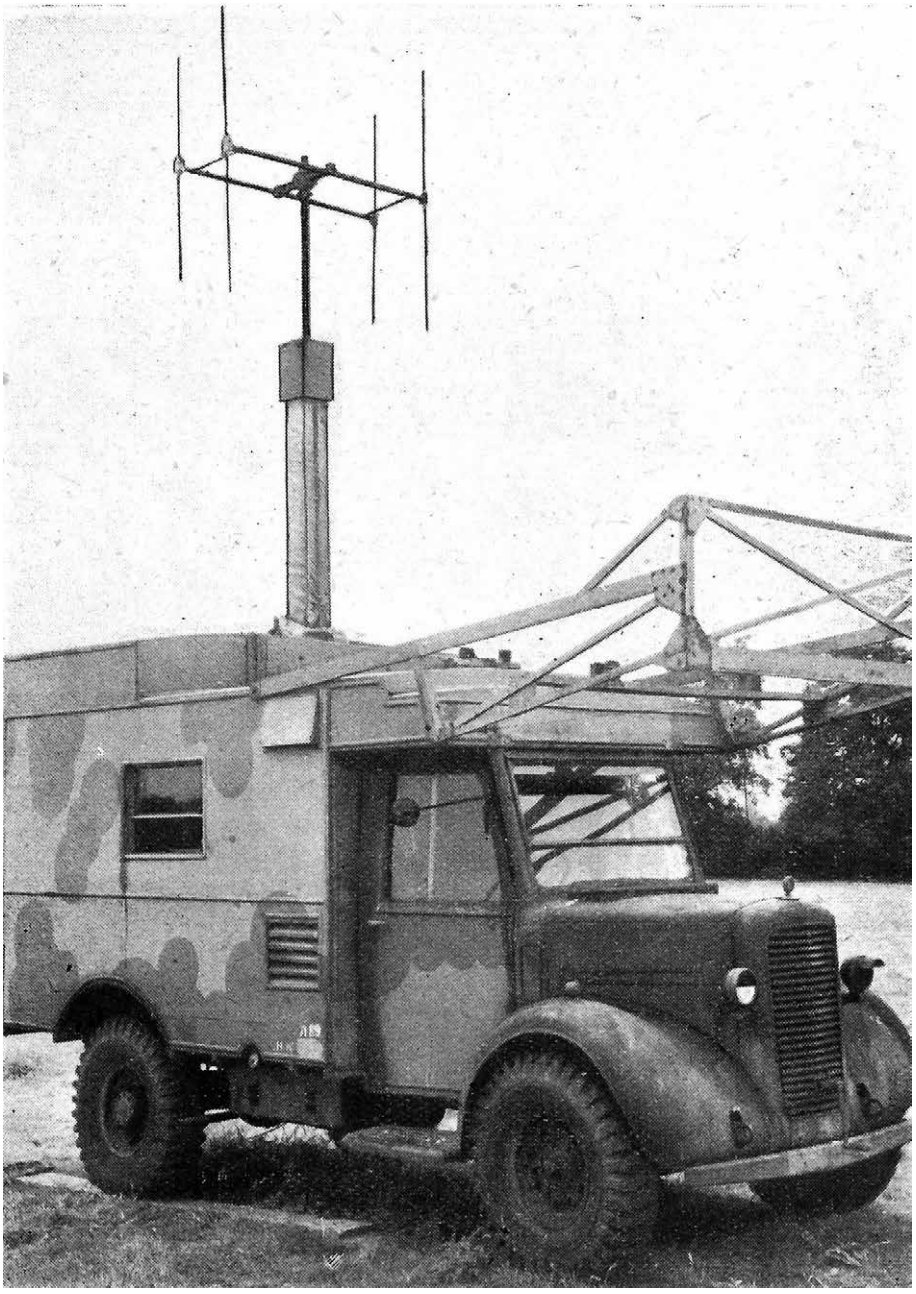
On 6 August administrative responsibility for the Fixer Station and its domestic site was transferred from Turnhouse to Charterhall (TNA, AIR 29/682).

The official history of the Women's Auxiliary Air Force noted that in April 1943 it was agreed that WAAF should substitute RAF personnel at D/F stations at the rate of 75%, but that it was found that WAAF were least successful in these D/F posts. It was claimed that WAAF were considered to be temperamentally unsuitable for this work and were gradually withdrawn from these duties (Air Ministry, 1953: 89). However, as noted above at Balthayock and Hawthornside, WAAF continued working at D/F stations in 1944 and beyond.

At 10am on 23 April 1945 the mobile fixer at Cauldhame was removed to Skeabrae airfield for homing purposes, but the tower at Cauldhame remained in use as a Fixer Station (TNA, AIR 16/915).

Findochty Fixer was struck by lightning at 8.30pm on 7 June 1945 and any requests for fixes required 15-20 minutes' notice to allow time for the stand-by power plant to warm up. It was not until 7am on 8 June that Findochty was back operating as normal. Shebster Fixer was struck by lightning at 10am

35 Cauldhame VHF Fixer station in Orkney, circa 1956 (© Moar Family, via Tommy Matches).



36 Mobile VHF Fixer station, on a Commer Q2 15cwt truck (© Historical Radar Archive).

on 7 February 1946. There were no casualties but the station was unserviceable until 11am (TNA, AIR 16/915).

Warthill mobile fixer stood down around 5.10pm on 17 June 1945 (TNA, AIR 16/915). Lybster Fixer Station closed down on 31 January 1946. Turnhouse received instructions from No 13 Group on 18 March 1946 that the VHF Fixer Stations at Hercha Hill, Gowanfield and Cairn Hill were transferred to Dyce for the purpose of closing down. They closed on 10 April 1946, along with the VHF Fixer at Findochty. Hill Rig Fixer station had closed prior to this, on 1 April 1946 (TNA, AIR 25/234; AIR 28/1138).

VHF Fixer Stations

The following list of VHF Fixer Stations is as complete as possible, based on available sources. It excludes VHF Homers and other VHF installations used for purposes other than providing aircraft fixes. Sites have been identified and confirmed as of Second World War date from the following files at The National Archives: AIR 2/2879, AIR 2/4495, AIR 2/4496, AIR 2/8535, AIR 16/915 and AIR 28/804.

Fea Hill	(Kirkwall Sector Fixer 'E')	HY 6399 4004
Cauldhame	(Kirkwall Sector Fixer 'A')	HY 2726 2802
Warthill	(Kirkwall Sector Fixer 'B')	HY 5266 0118
Shebster	(Kirkwall Sector Fixer 'C')	ND 0120 6452
Lybster	(Kirkwall Sector Fixer 'D'/ Tain Sector Fixer 'A')	ND 2566 3613
Melvaig	(Stornoway Fixer 'A')	NG 7499 8324
Aird	(Stornoway Fixer 'C')	NF 7621 5494
Portmahomack	(Tain Sector Fixer 'B')	NH 9274 8588
Findochty	(Peterhead Sector Fixer 'A')	NJ 4719 6726
Gowanfield	(Peterhead Sector Fixer 'B'/ Tain Sector Fixer 'C')	NK 0326 6362
Cairn Hill	(Peterhead Sector Fixer 'F')	NJ 7525 3659
Perwinnes Moss/ Corse Hill	(Peterhead Sector Fixer 'C)	NJ 9337 1217
Scarinish	(Tiree Sector Fixer 'A')	NM 0370 4383
Herscha Hill	(Peterhead Sector Fixer 'E')	NO 7364 8063
Upper Dysart	(Peterhead Sector Fixer 'D'/ Tealing Fixer 'B')	NO 6819 5385
Tullyfergus	(Tealing Fixer 'A')	NO 2100 4907
Balthayock		NO 1696 2378
Hill Rig	(Ayr Sector Fixer 'E'/ Grangemouth Fixer 'C')	NS 9001 4902
Coillabus	(Ayr Sector Fixer 'A')	NR 3192 4394
Pisgah	(Ayr Sector Fixer 'C')	NS 4065 2876
Outhmuir	(Turnhouse Sector Fixer 'D')	NT 0723 9431
Largoward	(Turnhouse Sector Fixer 'B' Tealing Fixer 'C')	NO 4864 0765

Lettermuir	(Grangemouth Fixer 'B')	NN 6191 0406
Straiton	(Turnhouse Sector Fixer 'A')	NT 2793 6688
Alderston Hill	(East Fortune Fixer 'A')	NT 4905 7513
Greenock	(Ayr Sector Fixer 'B')	NS 2697 7454
Cumbernauld	(Grangemouth Fixer 'A')	NS 7557 7615
Lamberton Moor	(Turnhouse Sector Fixer 'C'/ Charterhall Fixer 'A'/ Milfield Fixer 'A")	NT 9465 5851
Hawthornside	(Turnhouse Sector Fixer 'E'/ Charterhall Fixer 'B'/ East Fortune Fixer 'C'/ Eshott Fixer 'B')	NT 5563 1142
Brough	(Ayr Sector Fixer 'D')	NX 0001 7063
Muncraig		NX 6153 4640
Panteth Hill		NY 0778 7178
Skipmyre	(Annan Fixer 'A')	NY 0375 8100
Shoreswood	(Ouston Sector Fixer 'A')	NT 9356 4632
	(East Fortune Fixer 'B')	NT 9419 4568
	(East Fortune Fixer 'E')	NT 9410 4552
Maidens Hall	(Ouston Sector Fixer 'B')	NZ 2345 9827
Haydon Bridge	(Ouston Sector Fixer 'C')	NY 8441 6656
Cumwhitton	(Annan Fixer 'C')	NY 5008 5202
Dean Moor	(Annan Fixer 'B')	NY 0441 2145

In October 1941 it was decided that four additional Fixer stations were required in Kirkwall Sector:

Fair Isle No 1	connected to Kirkwall
Fair Isle No 2	connected to Lerwick
Scatsta	connected to Lerwick
Skaw	connected to Lerwick

Preliminary siting had already been carried out but in view of the very exposed nature of these sites it was requested that permanent stations be provided on a high priority. However, none of these four stations were built. Certainly, it was impossible to provide a telephone line to Fair Isle No 1 without giving up an alternative line, but a line from Lerwick to Fair Isle No 2 was considered possible (TNA, AIR 2/8535). However, the following four VHF Fixer Stations in Shetland were built, but they did not become operational (Gordon Carle, pers comm).

Crussa Field, Unst	HP 6126 1085
Eshaness	HU 2104 7806
Hill of Swinister	HU 4510 7325
Flossy Knowes, Whalsay	HU 5817 6505

37 Map of VHF D/F Fixer stations (© Historic Environment Scotland).

The Superintending Engineer from No 15 Works Area, Aberdeen, noted on 29 July 1943 that the Section Officer at Wick,

> *understood that the Post Office have not agreed to run a telephone line to these sites* [Eshaness and Flossy Knowes]*, and it seems doubtful whether the agreement will in fact be forthcoming, in view of the fact that the matter has been under discussion between them and the Air Ministry for a long time. It is, unfortunately, not worth suspending work on these sites but it is not proposed to instal generators until some definite assurance is received that these sites will be occupied. Both these stations are complete but have not yet been installed …*
>
> *It is requested that the Superintending Engineer be provided with information either from Air Ministry or No 26 Group, whether a decision has been reached as regards a telephone line to Eshaness and Flossy Knowes* (TNA, AIR 2/4496).

The Superintending Engineer also noted the following regarding the site at Crussa Field:

> *The Section Officer was informed by the Technical Liaison Officer on his last visit, that the site of the VHF tower is incorrect, and in his opinion of no use. The building has been set out in accordance with the Air Ministry plan, and it can only be assumed that this plan is incorrect. Unfortunately, the building is now complete, including the blast wall, but pending further instructions no steps will be taken to provide a cable between the Power House and the tower. The top of the tower is just level with the highest point of the hill* (TNA, AIR 2/4496).

George Polson left school in 1943 and was employed working with the RAF personnel who were building Isbister VHF Fixer Station in Shetland. He owned a Shetland pony and transported aggregate for the track as well as the foundations at the top of the hill called the Wart. He was well paid, earning 2s 6d an hour, more than many skilled craftsman. A wall was built around the octagonal foundations at the top of the hill and a three-storey wooden hut, around 30 feet tall, was put up within the wall. A ladder was fixed at the centre enabling ascent to the top floor, with windows on the top floor. Mr Polson didn't recollect any equipment being installed before work was discontinued (Gordon Carle, pers comm).

Although the permanent Fixer Stations did not become operational, there were two mobile Fixers in the Lerwick Sector, at Sumburgh (Exnaboe) and Swinister, which were in operation from 12pm until 8.40pm on 11 April 1945, with Exnaboe used again during fixing exercises later in the month (TNA, AIR 16/915).

Chapter 4

Communications networks

Telephonic communications

To keep the air defence organisation outlined in Chapters 1-3 up to date with information from a multitude of different sources, a vast network of communications was required. Tellers at radar stations passed aircraft plots over direct speech circuits (or in the case of some of the stations on the islands, by W/T or R/T, using coded plotting grids) to the relevant filter room, where it was plotted on the tables. Once filtered, the 'true' aircraft plots were re-told in detail by observers on the balcony via speech broadcast circuits to the Group Operations Room and to Sector Operations Rooms within the Group area. Other observers relayed the information in lesser detail (ie, the highlights) to adjacent Groups and to Fighter Command Headquarters. Observers in the Sector Operations Room passed all relevant information from the plotting table to Gun Operations Rooms of Anti-Aircraft Command and to Balloon Command. Speech circuits also existed between the Sector Operations Room and such points as the flying control tower located at each airfield and to the R/T transmitting and receiving stations. Liaison and intelligence circuits connected with the plotting organisation existed between all the stations mentioned above (Hanna, 110).

To achieve the above required not only a vast communications network, but one that was many times larger than had previously existed for military use. Prior to the outbreak of war in September 1939 a comparatively small network of private telephone circuits existed for the military. This comprised a number of long-distance circuits, normally in use for the public system and capable of being switched at short notice to form a network of approximately 500 private telephone circuits, and a much greater number of permanently rented circuits under 15 miles in length. The former, switchable, circuits were known as Emergency Circuits, the majority of which were switched into service during the last fortnight of August 1939. Following this, most of the additional circuits requested were provided on a permanent basis (Harbottle, 125).

The network of private telephone circuits grew rapidly during the Second World War. The size of the military long distance telephone network across the UK reached a peak of 9,300 circuits in August 1944. It is estimated that the total number of private telephone circuits in use by the military in August 1944 exceeded 60,000 (Harbottle, 125-126). At Greenock telephone requirements grew until some 80 separate establishments existed, the telephone traffic being later concentrated on a few larger switchboards. An inter-service telephone and telegraph switching centre was set up at Cambuslang, near Glasgow (Alston, Bland, Perryman and Worthington, 116).

Islay was connected by virtue of the laying of an underground cable from Lochgilphead to Campbeltown, and a 4-channel carrier system on submarine cables from Kintyre. The pre-war single-core cable from Tiree to Tobermory on Mull was replaced with a new submarine cable carrying five carrier systems, each providing one audio and two carrier circuits. These links to Tiree were all military private wires. Mull was linked to Oban by 6-channel ultra-short-wave radio links. The issue of provision of communication to Benbecula was solved by laying a 54 mile length of coaxial type solid dielectric submarine cable to Loch Slapin in Skye. The cable was extended by balanced pair cable to Kyle of Lochalsh, where the carrier terminal was located (BT Archives, TCB 422/11438; Alston, Bland, Perryman and Worthington, 116).

Stornoway was already linked to Ullapool by radio, the circuits being extended on a 3-carrier system superimposed on aerial lines to Inverness. It was necessary, however, to open up a new route and a second radio link was constructed to work from Stornoway to Melvaig, north-west of Gairloch. The radio equipment was installed in January 1942, with the circuits handed over on 26 June. The repeater station on the mainland was located at the head of the loch and a 3kV power cable and an unloaded telephone cable were run between the 12-circuit carrier terminal and the wireless station. From Gairloch repeater station the circuits were routed in an armoured audio cable to Achnasheen, where it joined a similar cable from Kyle of Lochalsh and thence to Inverness (BT Archives, TCB 226/930; Alston, Bland, Perryman and Worthington, 116).

In addition, there was an existing 4-core telegraph cable from Staffin Bay in Skye to Ranish in Lewis and in December 1940 it was decided to use this to provide additional circuits between Kyle of Lochalsh and Stornoway. This was to meet an urgent need for circuits to the Western Isles. The existing telegraph cable was extended with overhead cable to provide circuits between Stornoway and Kyle of Lochalsh. The three new circuits became available on 10 February 1941, but due to a delay in providing circuits between Kyle of Lochalsh and Inverness were still not in use when more permanent equipment was fitted on 24 June 1941 (BT Archives, TCB 422/11335, TCB 422/11364, TCB 422/11408).

Telephone communications were practically non-existent in certain areas of the Highlands and Islands before the war. Despite great efforts by the Post Office during the early part of the war in extending the network, communication facilities remained limited in extent. These limitations resulted in a complex filtering organisation. Radar stations on the north-east and northern coasts of

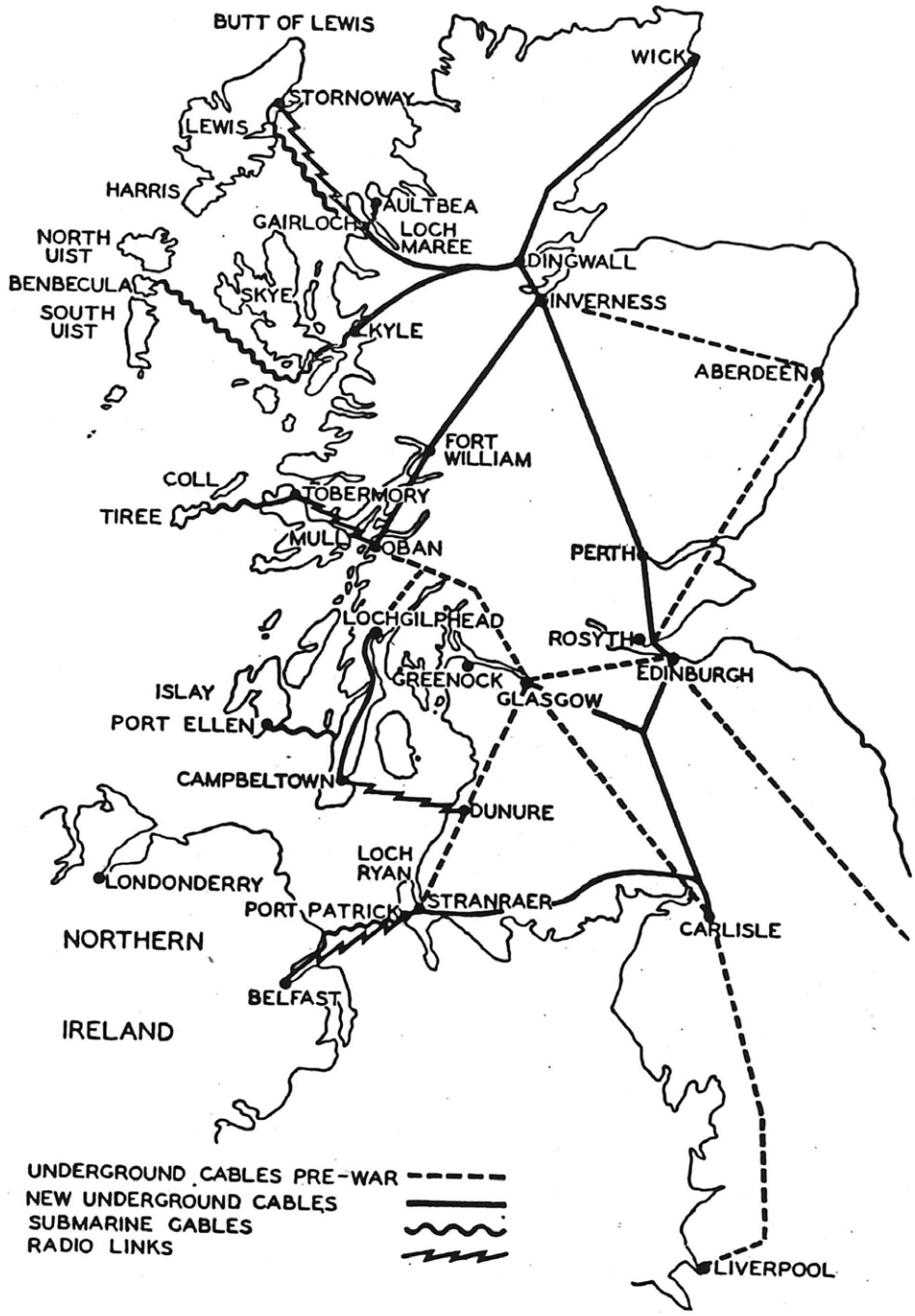
Scotland and the Orkney Islands were connected to Inverness Filter Room. Radar stations in the Shetland Islands were connected to Lerwick Sub-Filter Room, in Lewis and bordering the Minch they were connected to Stornoway Sub-Filter Room and radar stations in the vicinity of Oban and Tiree used Tiree Sub-Filter Room (HRA, RDF in Northern Scotland and the Islands).

In order to provide adequate telephone communication between Lerwick and Kirkwall, co-axial submarine cables were laid in July 1940, with land cable provided to complete the link between both places (BT Archives, TCB 422/11072). Between Lerwick and Inverness two telephone circuits were available for filter room purposes. The first was used as a line for telling filtered information; the second was used for the purpose of passing raw unfiltered plots from radar stations when a station in one filter area plotted in the adjoining area. Stornoway and Tiree had only one line to Inverness Filter Room for the purpose of passing both filtered and raw information, which unfortunately meant a serious loss in filtering efficiency (HRA, RDF in Northern Scotland and the Islands).

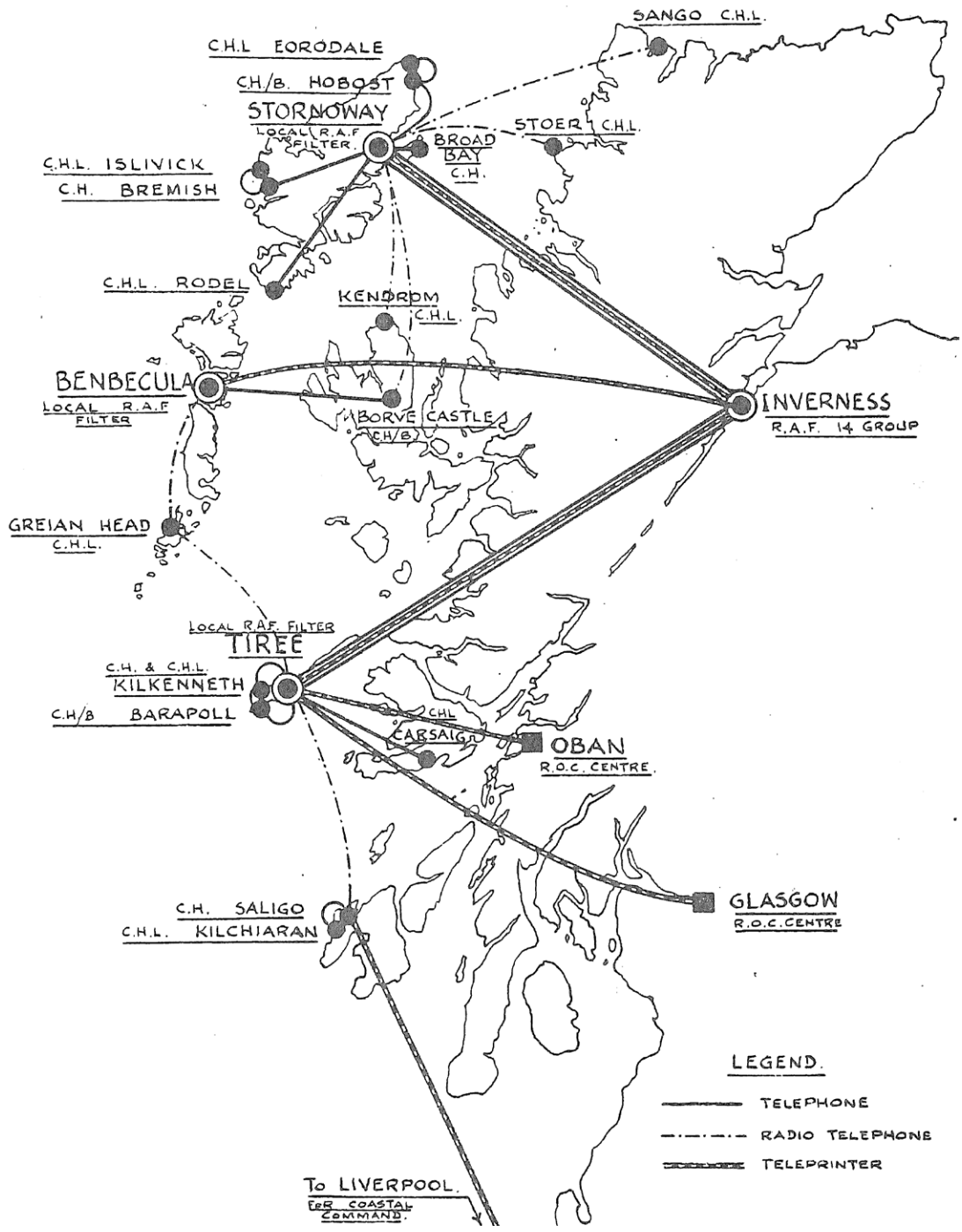
The majority of plotting circuits in use by Fighter Command were of the unidirectional, point-to-point type. Within an Operations Room they were routed via a Floor Supervisor's keyboard (for monitoring purposes) and a patching panel, to predetermined plotting positions. Point-to-point circuits were necessary by virtue of the continuous nature of the information passed, and because the shortest of switchboard operating delays could still not be tolerated (Hanna, 110).

The patching panel provided a large measure of flexibility in as much as any particular plotting circuit could be connected to any desired plotting position at the table. This was especially useful when the map, which was often composed of removable sections, was moved up or down or across the table. During quiet periods it was possible to connect several plotting circuits to one plotting position, achieving a reduction in the number of plotters on duty. To avoid an un-noticed disconnection in the uni-directional circuits, an 800 cycles per second pip-tone of 100-150 millisecond duration was transmitted from the telling end at 30 second intervals. Its absence at the plotting position indicated the existence of a fault (Hanna, 110).

The standard GPO 65-line PBX switchboard served many important functions, most importantly for administrative services at all Fighter Command stations, flying control arrangements at airfields and the movement liaison section at Group Headquarters. The majority of circuits terminating in the Operations Rooms were of the point-to-point type, due to the vital nature of the messages passed over them. Access to the lesser important circuits was made via the Operations PBX, which consisted normally of a four-position PMBX No 1A switchboard on which were terminated lines to satellite airfields, aircraft dispersal points, flying control offices, etc. The Flying Control PBX situated in the control tower on airfields provided intercommunication between the Flying Control Officer and such points as the ambulance service, crash tender, Sandra beacons, FIDO control and dispersal points. Communication was also available through this PBX to the parent Sector and Group Headquarters (Hanna, 112).



38 Growth of the underground cable network in Scotland during the Second World War (© The Institute of Telecommunications Professionals, G A Alston, F E Bland, C F Perryman and C E Worthington).



39 Communication links between radar stations in the Western Isles and North-West Highlands, Sub-Filter Rooms and Inverness Filter Room at Headquarters No 14 Group, circa late 1942 (© TNA WO 199/534).

Landlines on and in the vicinity of RAF stations were placed underground. The reasons were three-fold: to avoid obstruction to flying, to give additional security from attack and to avoid possible interference with wireless signals. Security was a particular factor at Sector Stations but the protection of cables into HQFC and Fighter Groups was also a concern. Plans to bury cables up to 20 feet below surface level were found to be unfeasible and therefore it was agreed on 23 May 1939 that cables to HQFC would terminate in concrete pillboxes just inside the Air Ministry site with a separate pillbox being provided to terminate the circuit to each outlet. From each pillbox, two cables were laid to the underground Operations Block, one to the west entrance and a reserve to the east entrance. This system was adopted at all Fighter Command Groups (Air Ministry, 1958: 36-38).

Teleprinter communications

In 1938 it was proposed by the Post Office Engineering Department that requirements for telegraph circuits for defence purposes could only be met by the setting up of a network partially independent of the civil network. This had the advantage of reducing the requirements for private wire telephones since the telegraph terminals could also include telephone amplifying and signalling equipment, thus allowing for the setting up of 4-wire circuits between all military establishments (Nancarrow, 121).

Treasury authority was given in 1938 for the provision of a telegraph network, known as the Defence Teleprinter Network (DTN). At its inception the scheme provided for all the then projected telegraph requirements of the Air Ministry serving Fighter, Bomber, Coastal and Maintenance Commands together with associated services, as well as Admiralty and War Office needs (Nancarrow, 121, 123). Under Phase I, completed by the end of May 1939, there were three main centres at Stanmore (HQFC), Uxbridge in north London (HQ Bomber Command) and Lee-on-Solent in Hampshire (HQ Coastal Command), although HQ Coastal Command moved from Lee-on-Solent to Northwood in Hertfordshire in August 1939 and used Uxbridge and Stanmore centres (TNA, AIR 2/4139; Air Ministry, 1958: 30, 38; Sturtivant, 2007: 92). The first multi-channel voice frequency telegraph system of the DTN was opened on 31 March 1939 between Uxbridge No 1 and the GPO telephone exchange in Faraday Building, London. This was followed on 4 April by a system between Uxbridge No 1 and Stanmore No 1 (Nancarrow, 121, 123).

Phase II of the DTN saw a large number of new installations added, including Central Signals Centre at Leighton Buzzard in Bedfordshire which opened in early May 1939, with the first ten 12-channel teleprinters installed there by the end of July 1939 (Air Ministry, 1958: 31, 38, 336). Phase II also saw No 11 (Fighter) Group HQ at Uxbridge, No 12 (Fighter) Group HQ at Hucknall and No 13 (Fighter) Group HQ at Newcastle linked to the DTN. Installation of equipment at Newcastle by the Standard Telephone and Cable Company started in July 1939. No 13 Group at Newcastle was linked to HQFC, Central Signals Centre and the FSHQs at Catterick, Church Fenton, Turnhouse and Usworth

(TNA, AIR 2/4135; Air Ministry, 1958: 31). Each of the Fighter Groups had one operations teleprinter line and one intelligence line to each fighter station, a total of two administrative lines and one meteorological line, with one extra administrative line added in wartime. Each of the fighter stations had one administrative teleprinter channel, one operations and one meteorological channel, with an intelligence line added in wartime (Air Ministry, 1958: 36).

There was also a requirement for additional Defence Teleprinter Network centres across the UK, including one in Glasgow. It was noted in May 1939 that it was essential that this centre be ready for GPO engineers to install equipment by 30 October, to allow the installation to be completed by 31 December 1939 (TNA, AIR 2/4135), and Glasgow centre was certainly operating before the end of January 1940 (TNA, AIR 2/4136).

The outbreak of war placed a heavy load of traffic on the DTN and there was a vast increase in the demand for lines for operations, intelligence, meteorological and administrative channels for the increasing number of stations under Fighter and Bomber Commands. As a result, the network considerably outgrew the original concept (Air Ministry, 1958: 35-36, 39-40). Phase III included plans to expand the provision at Glasgow. A meeting at the GPO in London in March 1940 proposed an expansion of facilities in Glasgow, principally to support expanded Naval communications, with a second centre, Glasgow No 2. It was agreed that new facilities should be constructed five miles outside Glasgow at Flemington, near Cambuslang, with additional equipment installed at the Glasgow Repeater Station until the new building was completed (TNA, AIR 2/4138). These plans were amended later in Phase III, with Glasgow No 2 moved to Cambuslang, where it became operational, probably in early 1941 (TNA, AIR 2/5215).

By the end of 1941 Phases I to III were complete. Phase IV, originally planned to be finished by March 1942, in fact ran well into the 1942/43 financial year. This phase included the establishment of the North-West Central Switching Centre at Blackbrook, near Liverpool which became operational in December 1941 (Air Ministry, 1958: 58, 72). Phase IV also saw the FSHQs at Ayr, Benbecula, Peterhead, Stornoway, Tain and Tiree (and Reiss Sub-Sector) connected to the DTN as well as a second link for the Inverness Group HQ (TNA, AIR 2/5215).

Phase V was mostly deferred until 1943/44 due to limitations in manufacturing and installation capacity but included the setting up of the South-West Central Switching Centre at Hawthorn in the Corsham Caves in Wiltshire, alongside the underground protected Operations Block for No 10 (Fighter) Group at Rudloe Manor. The South-West Central Switching Centre opened in September 1943 (Air Ministry, 1958: 58-61).

The extent of the growth of the DTN can be seen by the fact that in September 1939 the average number of messages passed every day was 2,000 of which approximately 500 were passed through the Central Exchange at Leighton Buzzard. By October 1941, Leighton Buzzard was dealing with 6,000 messages daily. Between April and June 1944 well over 1,000,000 messages were sent on the DTN (Air Ministry, 1958: 72).

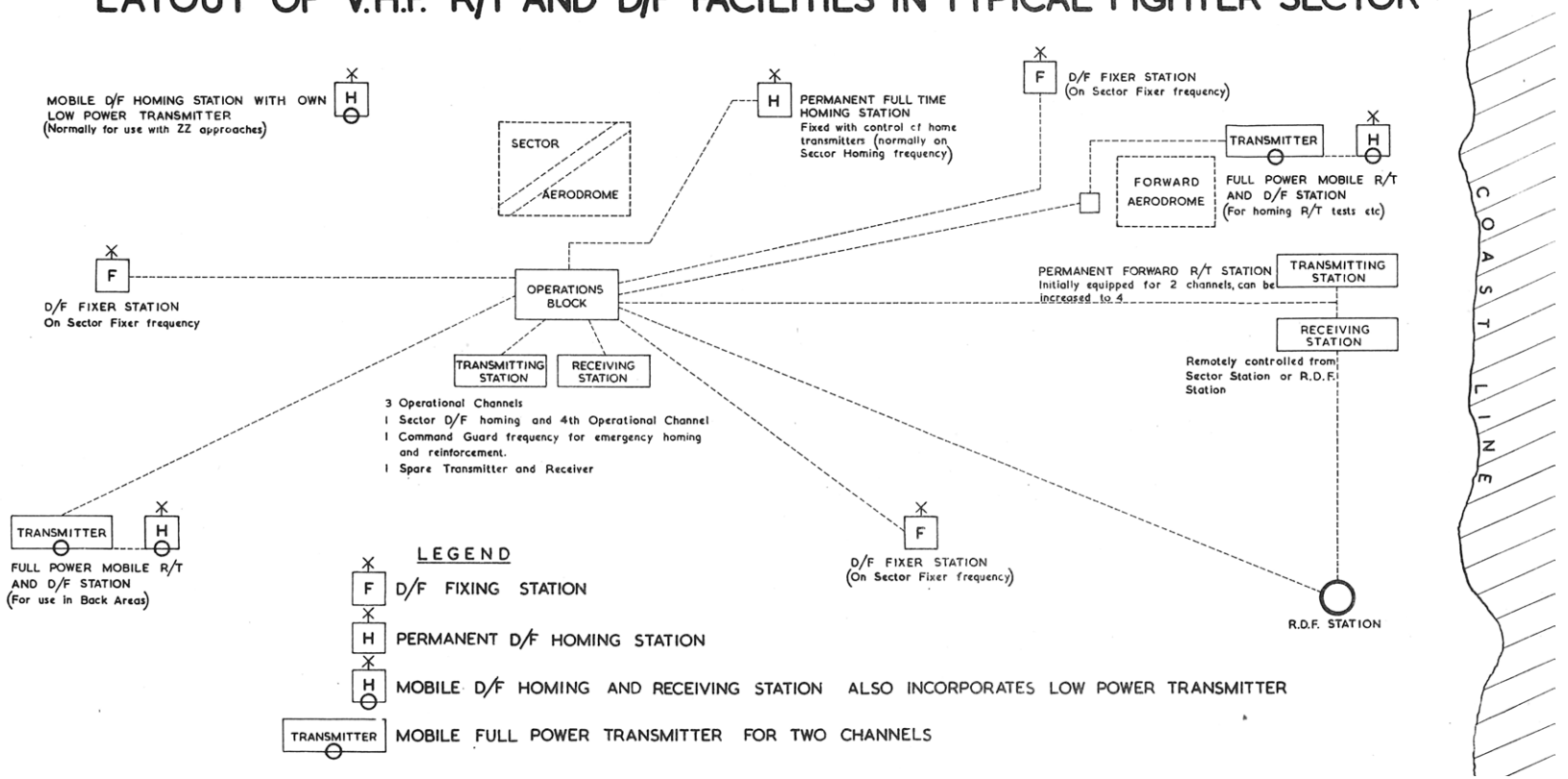
40 T1154 W/T transmitter used at Eorodale CHL radar station for communications (© Quinton MacMillan).

Wireless communications

Direct speech landlines were used for most telling of radar plots, although teleprinter links and W/T were also used. For example, Eorodale CHL told plots to Inverness Filter Room from 24 November 1941 using the teleprinter service from Stornoway to Inverness, and W/T to tell to Stornoway Sub-Filter Room (TNA, AIR 26/92).

41 R1084 W/T receiver used at Eorodale CHL radar station for communications (© Quinton MacMillan).

Plotting by W/T was undesirable as it could be intercepted by the enemy. To introduce an element of security, plots were passed on a transposed grid. The radar station used for a limited period a grid on which the station position bore no relationship to its true position. The radar station plotted directly on the transposed grid and the plots were converted to true grid at the filter room by a simple machine. The transposed grid was changed every three or four days. The disadvantage of this system was that it took more time for a W/T plot to reach the filter room than one passed by telephone. This was due to the process



42 Layout of VHF R/T and D/F facilities in a typical Fighter Sector during the latter part of the Second World War (TNA, AIR 2/1379).

involved: the radar operator gave range and bearing, which was converted on the transposed grid to a four-figure grid reference which was then transmitted by the W/T operator, the plot was received by the filter room plotter, converted from transposed to true grid by the filter room converter and then passed to the plotter on the filter table. The average age of a plot from Sango CH radar, passed by W/T to Kirkwall Filter Room was 42 seconds and that with practice this could be reduced to 30 seconds. Via telephone the plot was usually some 15 seconds old, so the speed of processing W/T plots was considered very good (HRA, RDF in Northern Scotland and the Islands).

At the start of the Second World War the TR9 high frequency radio was used for ground-to-air communication, but the range of this equipment was too short and its performance too variable to allow for efficient communication. Fighter Sectors used Forward R/T Stations to extend the range of ground-to-air communications between the FSHQ and fighter aircraft under their control. However, the short range of fixing by D/F restricted the area over which fighters could be positioned (Air Ministry, 1952: 42). Turnhouse Sector used three Forward R/T Stations, at Leuchars, Drem and Cockburnspath. These used the TR9D transceiver, operating on an HF frequency of 4890 kc/s with a back-up frequency of 5210 kc/s (TNA, AIR 14/273). The HF R/T relay tender at Cockburnspath was withdrawn during September 1941 (TNA, AIR 2/7131), presumably due to the full implementation of VHF in Turnhouse Sector by that date. The use of forward relay stations continued in use throughout the war and after the end of hostilities in 1945, and forward relay stations are known to have been located at Tain and Peterhead (TNA, AIR 16/915).

Communication with aircraft in distress was also vital. The RAF worldwide distress frequency was 116.1 Mc/s, and use of this frequency was strictly limited to aircraft in distress. Distress was taken to include emergencies, such as diversion or forced landing, but any other use of the frequency by aircraft had to be reported through the usual channels. Each Fighter Group had two Guard frequencies, Group Guard 1 & 2. The Group Guards were used for reinforcement by day or night, Air/Sea Rescue communications (other than fixing of aircraft in distress), Group controlled operations, emergency homings to stations outside the parent Sector, coastal convoy escort and for aircraft in transit outside their Group. In addition, Fighter Command had a Guard frequency known as Command Guard. This guard frequency was available for use by any aircraft of any Command if fitted with VHF, in transit between UK and overseas areas and was therefore also referred to as World Guard (TNA, AIR 16/915).

Frequencies allocated to Sectors were numbered SF1, SF2, etc to the numerical extent of the frequencies allocated. One SF from each Sector's allotment was permanently allocated as the Flying Control and Homing frequency (aircraft channel A) and one other as the Fixing & Sector Control frequency (aircraft channel D). The remaining SFs were intended mainly as GCI frequencies. The Flying Control frequency (aircraft Channel A) was reserved exclusively for communication connected with Flying Control, ie Homing, ZZ, Local Beam Approach, and practice flying not involving Sector Control. Fixing did not take

43 TR9D high frequency radio set (museum number EF.2019.38 © Trustees of National Museums Scotland).

44 TR1143A VHF radio set (© Orkney Photographic).

place on A. The Sector Fixer frequency (aircraft channel D) was used for Sector Control and/or Fixing. When controlling was taking place on a channel other than the fixer, the Controller could use his discretion to whether to shift aircraft to button D for fixing or to voice fix on the control channel in use. Fixer Stations were to always keep watch on the Fixer frequency except when specially ordered otherwise (TNA, AIR 16/915).

World Guard watches constituted an emergency facility, initially intended as a safety organisation for night fighter aircraft in Fighter Command. Aircraft of other commands carried VHF R/T equipment which could operate on this frequency and the safety organisation was available for their needs. World Guard was only to be used in the following circumstances:-

a. an emergency
b. when its use had been formally authorised in an Operational Order
c. when prior permission for its use had been obtained from the Duty Group Captain, Headquarters Fighter Command through the Duty Signals Officer, Headquarters, Fighter Command

Stations maintaining continuous watch on World Guard were arranged regionally to cover, as far as possible, the UK and surrounding waters. Certain other stations maintained watch from dawn to dusk and others were prepared to open a watch on request. Continuous watches on 116.1 Mc/s were kept at the following locations. These locations were chosen so as to ensure complete cover of the land area of Scotland and the surrounding waters, assuming a ground-air/air-ground range of 60 statute miles at 5,000 feet.

- Ayr airfield (RNAS, watch maintained by Transport Command)
- Gallows Hill Forward Relay Station (Coastal Command) (no airfield, but homing could be arranged to Sumburgh)
- Kirkwall FSHQ (Fighter Command) (no airfield, but homing could be arranged to Skeabrae). Moved from Kirkwall to Wick on 17 December 1945
- Peterhead Forward Relay Station (Fighter Command) (no airfield, but homing could be arranged to Dyce)
- Stornoway airfield (Coastal Command)
- Tiree airfield (Coast Command)
- Tain Forward Relay Station (Fighter Command) (landing facilities at Tain airfield)
- Turnhouse airfield (Fighter Command) (watch kept at FSHQ)

Other watches on 116.1 Mc/s were kept at the discretion of other Commands, but the watches listed above formed an essential common-user service (TNA, AIR 16/915).

PART II

Histories of the air defence centres covering Scotland 1938-46

Aberdeen

Unit	Gun Operations Room
Region	Aberdeenshire
NGR	NJ 8439 1008 (Clinterty House, Bucksburn)
NMRS	NJ81SW 99
In use	1940 – early May 1942

Unit	Gun Operations Room
Region	Aberdeen City
NGR	NJ 9185 0625 (54 King's Gate)
NMRS	NJ90NW 583
In use	early May 1942 – 11 August 1944

Unit	Gun Control Room
Region	Aberdeen City
NGR	NJ 9530 0985 (AB5 Command Post)
NMRS	NJ90NE 41
In use	11 August 1944 – 1945

It was decided at a conference at Rosyth on 16 January 1940 to apply for anti-aircraft defence for Aberdeen Harbour, and subsequently a reconnaissance was carried out on 20-22 January by Lieutenant Colonel GDK Murray (Officer Commanding 101 AA Regiment) and Major JV Truscott (36 AA Brigade). On 17 February four 3.7-inch mobile anti-aircraft guns arrived at AB1 site and made ready for action by two sections of 228 AA Battery, 94 AA Regiment (TNA, WO 166/2128).

In April 1940 it was noted that there was an existing telephone line from Dyce to Bucksburn GOR (TNA, AIR 2/7128), indicating that the GOR was located at Clinterty House, Bucksburn, co-located with the HQ of 94 HAA Regiment

(TNA, WO 166/2128). Clintery House was built by Major Hay of Seaton (Hamilton, 1960: 132). It was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room in Aberdeen, confirming that the GOR at Clinterty was operational at that time (TNA, WO 166/2129).

A new Gun Operations Room, a Class 'B' GOR, located at 54 King's Gate, was not yet operational in April 1942 but was commanded by Captain GH Lamb, and had four Second Lieutenants on strength (TNA, WO 166/6851). Designated 343 GOR, the new GOR appears to have become operational before 15 May 1942 (TNA, WO 212/81).

On 16 December 1943 the Commanding Officer of No 598 Squadron, Squadron Leader Duguid, visited Aberdeen GOR and had a liaison talk with Lieutenant-Colonel J Ruggles-Brise. On 8 February 1944 arrangements were agreed between the GOR and 598 Squadron regarding special co-operation exercises to be given by the squadron at least once a week using Supermarine Spitfires or Hawker Hurricanes (TNA, AIR 27/2057).

Squadron Leader Tideman from No 598 Squadron visited the GOR on 15 June 1944 to arrange for installation of a ground wireless pack set. He returned on 18 June in connection with the same matter (TNA, AIR 27/2057).

On 7 August 1944 No 598 Squadron received notification from 8 AA Group HQ that Anti-Aircraft Operations Room Aberdeen was to be closed down and a Gun Operations Room established instead as from 12.00pm on 11 August 1944 (TNA, AIR 27/2057). 343 GOR/AAOR at Aberdeen did indeed close down on 11 August 1944 and a Gun Control Room was established in the command post of AB5 Heavy Anti-Aircraft Gun emplacement (TNA, WO 166/14638).

On 17 December 1944 a private wire telephone line was completed between Aberdeen Gun Control Room and Vulnerable Point 364 (TNA, WO 166/15515). No date is recorded for the closure of the GCR, but it must have been during 1945.

Aberdeen

Unit	Observer Centre
Region	Aberdeen City
NGR	NJ 9371 0646 (Old Royal Infirmary, Woolmanhill, Aberdeen)
NMRS	NJ90NW 185.01
In use	1 November 1939 – 12 May 1945

Unit	Emergency Centre
Region	Aberdeen City
NGR	NJ 9329 0691 (Rosemount Church Hall, Rosemount Terrace, Aberdeen)
NMRS	NJ90NW 431.01

On 16 June 1938 Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command recommended the formation of No 38 Observer Group with Centre in Aberdeen and that this should be formed in 1941 (TNA,

45 Aberdeen Observer Centre, Autumn 1939. George A Williamson, Controller, is standing beside the table, at the left (via Derek Wood).

AIR 2/1772). However, the deteriorating European political situation meant that formation of the Group took place much earlier than this.

Difficulties were experienced in covering the complete area of No 38 Group due to the lack of telephone exchanges. The Commandant of the Observer Corps noted on 26 May 1939 that it would be necessary for the Air Ministry to rent a telephone line from Echt to Aberdeen, a distance of 12½ miles (TNA, AIR 16/48). Despite these challenges, No 38 Observer Group, with the Observer Centre at Aberdeen, was formed in June 1939 (TNA, AIR 25/232; Wood, 1992: 322) and recruiting for the Centre began in July with 140 men required. Candidates from executive positions were sought with staff from banks, insurance, law and business offices considered especially suitable (*Press and Journal*, 11 July 1939). However, more than a month later only 23 men had volunteered (*Press and Journal*,

46 George Williamson (Controller of No 38 Group) on left with Sir Windham Carmichael-Anstruther (Group Commandant of No 34 Group, Glasgow, from 1943-1944 and Group Commandant of No 38 Group from February 1945), taken in 1945 (© DC Thomson & Co Ltd).

17 August 1939) and this had only reached 40 the following day, leaving a shortfall of 100 (*Press and Journal*, 18 August 1939), which was filled by 29 August (*Press and Journal*, 29 August 1939). Following this, the Group was manned and in operation from 1pm on 1 November 1939 (TNA, AIR 16/49). The Controller at Aberdeen Centre was George A Williamson and the Observer Group Officer Colonel J Simpson (Wood, 1992: 66, 267). George Williamson was an advocate with the firm of Paull and Williamsons and former Aberdeen Town Councillor who had seen service with the Indian Army, retiring in 1923 with the rank of Captain (*Press and Journal*, 28 June 1939).

At 1pm on 1 November No 38 Group became operational with Mr J Archibald as Duty Controller in the Centre. The bell rang at that same moment indicating the first real plot appearing on the table. Mr Archibald checked that all Posts were answering the telephone and found that only K.3 Post (Buckie) was not responding. The personnel in the Centre were surprised to hear Mr Archibald ask the Assistant Controller to telephone Mr Valentine, the baker at Buckie. George Williamson, the Centre Controller, asked why he wanted the baker. Mr Archibald replied that Mr Valentine was the Head Observer at Post K.3 and it was not reporting (Wood,1992: 65-66, 325).

The Group area extended from Buckie to Stonehaven and inland to Braemar. Very severe weather could be experienced in this area, and in 1942 and 1943 during heavy snowstorms, many Posts were completely isolated. The Group suffered many raids by the German Air Force, especially in Aberdeen, Fraserburgh and Peterhead. The worst was probably the raid on Aberdeen in April 1943 which resulted in heavy casualties. Shipping and harbours on the coast of the Group area were subjected to raids almost every day or night from 1940 to 1942. Many Posts within the Group were machine-gunned and bombed, but fortunately without casualties (Winslow, 1948: 182).

The Observer Posts established within No 38 Group were as follows:

A.1	Rosehearty	NJ 938 675 (Nov 1939 – May 1945)
A.2	Inverallochy	NK 034 647 (Nov 1939 – May 1945)
A.3	Strichen	NJ 941 554 (Nov 1939 – May 1945)
B.1	St Fergus	NK 099 509 (Nov 1939 – May 1945)
B.2	Cruden Bay	NK 097 356 (Nov 1939 – May 1945)
B.3	New Deer	NJ 8855 4656 (Nov 1939 – May 1945)
B.4	Boddam	NK 127 411 (May 1940 – May 1945)
C.1	Inverebrie Hill	NJ 918 339 (Nov 1939 – May 1945)
C.2	Pitcaple	NJ 718 261 (Nov 1939 – May 1945)
C.3	Fyvie	NJ 772 379 (Nov 1939 – May 1945)
C.4	Udny Station	NJ 912 243 (13 Apr 1942 – May 1945)
D.1	Newburgh	NK 004 243 (Nov 1939 – May 1945)
D.2	Bucksburn	NJ 900 093 (Nov 1939 – May 1945)
D.3	Udny Station	NJ 912 243 (Nov 1939 – 13 April 1942)
D.3	Black Dog (Coastguard Watcher Post)	NJ 963 140 (13 April 1942 – May 1945)
D.4	Greg Ness	NJ 952 036 (Nov 1940 – Nov 1944)
D.4	Greg Ness	NJ 957 037 (Nov 1944 – May 1945)
E.1	Kintore	NJ 786 175 (Nov 1939 – May 1945)
E.2	Echt	NJ 741 053 (Nov 1939 – May 1945)
E.3	Alford	NJ 575 164 (Nov 1939 – May 1945)
F.1	Drumoak	NJ 7964 0051 (Nov 1939 – Apr 1941)
F.1	Drumoak	NJ 790 001 (Apr 1941 – May 1945)
F.2	Portlethen	NO 926 961 (Nov 1939 – May 1945)
F.3	Stonehaven	NO 877 850 (Nov 1939 – May 1945)
F.4	Feughside	NO 641 922 (Nov 1939 – May 1945)
G.1	Strathdon	NJ 352 130 (Nov 1939 – May 1945)
G.2	Tarland	NJ 479 045 (Nov 1939 – May 1945)

G.3	Ballater	NO 366 953 (Nov 1939 – May 1945)
G.4	Braemar	NO 146 905 (Jul 1940 – May 1945)
H.1	Kennethmont	NJ 549 287 (Nov 1939 – May 1945)
H.2	Kildrummy	NJ 467 179 (Nov 1939 – May 1945)
H.3	Cabrach	NJ 380 310 (Nov 1939 – May 1945)
J.1	Grange	NJ 497 511 (Nov 1939 – May 1945)
J.2	Huntly	NJ 524 399 (Nov 1939 – May 1945)
J.3	Drummuir	NJ 382 444 (Nov 1939 – May 1945)
K.1	Portsoy	NJ 582 660 (Nov 1939 – May 1945)
K.2	Aberchirder	NJ 621 522 (Nov 1939 – May 1945)
K.3	Buckie	NJ 429 650 (Nov 1939 – May 1945)
L.1	Gardenstown	NJ 806 646 (Nov 1939 – May 1945)
L.2	Turriff	NJ 730 504 (Nov 1939 – May 1945)
L.3	Macduff	NJ 708 644 (Nov 1939 – May 1945)

(TNA, AIR 2/20100, AIR 2/20102, AIR 2/20103, AIR 2/20104, AIR 2/20105, AIR 2/20107, AIR 2/20108, AIR 2/20109, AIR 2/20112, AIR 2/20113, AIR 2/20114, AIR 2/20115, AIR 2/20116, AIR 2/20117, AIR 2/20118, AIR 2/20119, AIR 2/20120, AIR 2/20121, AIR 2/20123; Wood, 1992: 321-322, 325, 329).

During the war, four German aircraft landed within the area of No 38 Group. The first was on 16 September 1940 when Heinkel He 115C seaplane, serial number 2754, force-landed in a field near New Aberdour. Three airmen were captured, the pilot admitting that he thought he was over the Firth of Tay. On 9 May 1943 Junkers Ju 88R-1 serial number 360043, coded D5+EV, from *Nachtjagdgeschwader* 3, defected to the UK and was escorted into Dyce. It brought with it the latest FuG 202 *Lichtenstein BC* airborne radar. About 18 months later, on 26 December 1944, Messerschmitt Bf 109G-14 serial number 463224 of *Jagdgeschwader* 77 made landfall at a height of 100 feet, eight miles south of Aberdeen then made direct for Dyce, although it crashed on landing at 3.31pm. The last of the four aircraft was Junkers Ju 188A serial number 190335, coded 1H+AT, from *Kampfgeschwader* 26 which, on 2 May 1945 defected from Trondheim. It made landfall at Inverallochy at a height of 50 feet and landed at Fraserburgh airfield (Winslow, 1948: 183; Butler, 1994: 17, 55; Ramsey, 1988: 105; Ramsey, 1990: 495).

When the system of running commentaries, given by the ROC direct to RAF sectors was initiated in March 1940, great assistance was given to fighters through Dyce Sector Operations Room in intercepting enemy aircraft. On 3 July 1940 three German aircraft were shot down by this running commentary method and nine days later a Heinkel He 111 was destroyed, the aircraft crashing

into the unfinished ice-rink on South Anderson Drive in Aberdeen (Winslow, 1948: 183-184; Atherton, 1993: 26).

The new position of Group Commandant was created in 1943 and between 1943 and 1945 the Group Commandant for No 38 Group was Observer Commander RS Pattison (Wood, 1992: 267) and from February to May 1945 it was Observer Commander Sir Windham Carmichael-Anstruther (*Press and Journal*, 20 February 1945).

No 38 Group, along with Nos 36 (Dunfermline), 37 (Dundee) and 39 (Inverness) Groups, was involved in a particularly efficient performance on the night of 9/10 June 1943. Four Vickers Wellingtons and two Armstrong Whitworth Whitleys from Lossiemouth and Kinloss airfields were on a night cross-country exercise when their airfields became fog-bound. Three of the Wellingtons were ordered to make for Banff and landed at 1.11am, 3.18am and 4.07am before that airfield was fog-bound. A Whitley was sent to Wick and landed there at 4.18am. The other Whitley was sent to Leuchars, landing safely there at 4.27am. The last Wellington was sent from Lossiemouth to Peterhead, which it was unable to find due to the weather, and then re-directed to Dyce. It was unable to land at Dyce as it was by then fog-bound and thus the Wellington was then sent to Leuchars, where it safely landed at 5.20am. With one exception, all six aircraft were tracked exclusively by the Royal Observer Corps, a remarkable feat considering the weather conditions (Winslow, 1948: 188-189).

Journalist GE Ley Smith visited Aberdeen Centre in the autumn of 1943 and described the staff there:

> *Control Centre is staffed mostly by professional men. That, however, is largely a matter of chance. The staff includes lawyers, chartered accountants, bankers, architects, insurance agents, commercial travellers, teachers, garage hands, shop assistants, and watchmakers. As members of the Royal Observer Corps are not sheltered from service with the forces, there have been many changes in personnel and today the proportion of women on the Control Centre staff is growing and may soon reach fifty per cent.*
>
> *They had their great test on the occasion of the Blitz* [the bombing of Aberdeen on 21 April 1943]. *"The women were splendid," said Mr* [George] *Williamson. "They showed no sign of nerves and carried through their work confidently and efficiently." Some of them are married women with families living in the danger area* (*The Press and Journal*, 7 October 1943).

Aberdeen Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Ardeer

Unit	Gun Operations Room
Region	North Ayrshire
NGR	NS 2788 4271 (IC1 Command Post)
NMRS	NS24SE 50
In use	1940 – 18 March 1942

Unit	Gun Operations Room
Region	North Ayrshire
NGR	NS 3173 3695 (IC2 Command Post)
NMRS	NS33NW 52
In use	18 March 1942 – circa 1945

On 1 June 1940 232 AA Battery moved from the Clyde to Ardeer, where two 2-gun, 3.7 inch mobile Heavy Anti-Aircraft gun sites (IC1 and IC2) were selected. Clyde GOR was connected to IC2 gun site (TNA, WO 166/2128).

The Battery Headquarters were located in Hawkhill Farm (TNA, WO 166/2128) and it was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room at Ardeer (TNA, WO 166/2129). This was located in the command post of IC1 HAA gun emplacement (TNA, WO 166/7371).

Ardeer Sub-GOR with all communications was moved from gun site IC1 to IC2 on 18 March 1942 (TNA, WO 166/7371). 326 Gun Operations Room, a Class 'B' GOR, was operating at Ardeer in May 1942 (TNA, WO 212/81). By September 1943 this had been downgraded to a Gun Control Centre, acting as the GOR for the Ardeer Gun Defended Area, but remained in the command post of IC2 HAA gun emplacement (TNA, WO 166/11216).

Ayr

Unit	FSHQ
Region	South Ayrshire
NGR	NS 3748 2913 (Rosemount House)
NMRS	NS32NE 85
In use	4 April 1941 – 10 May 1943

Fighter operations in the west of Scotland from January 1941 were controlled by Prestwick, with the FSHQ based in Powbank Mill (TNA, AIR 28/40). However, preparations were made to move to Rosemount House, in the parish of Symington in Ayrshire, a house which had been rebuilt circa 1770, for Dr William Fullartoun, and then extended in the first half of the nineteenth century (Davis, 1991: 361).

On 28 February 1941 Squadron Leader AVR 'Sandy' Johnstone, Officer Commanding No 602 Squadron, visited Rosemount House to check on progress, and noted in his diary:

> *I used the breather to inspect progress at Rosemount and Ayr and found painters putting the finishing touches to the former, whilst at last two dispersal sites could be occupied at Ayr. Unfortunately neither can be used for operational purposes as the Post Office has yet to install the telephone lines* (Johnstone, 1988: 252).

Operations moved to Rosemount House on 4 April 1941, at which time communications were still in skeletal form. However new lines were being run in daily. On 7 April RAF Ayr opened as an operational airfield and a Fighter Sector within No 13 (Fighter) Group, even though the FSHQ had already been operating at Rosemount for three days (TNA, AIR 28/40).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 206 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries. The first GLO at Ayr was Lieutenant ASA Stewart, who reported at Rosemount on 14 April 1941 (TNA, AIR 28/40).

Squadron Leader Hector MacLean was a Sector Controller posted to Ayr on 3 April 1941 (Johnston, 1986: 265):

> *Early in 1941 I was posted as a Controller to RAF Station Ayr, a new fighter base in the course of construction at the village of Heathfield near Ayr … The new sector operations room responsible for the air defences of the west and north-west of Scotland was just coming on stream at Rosemount, a secluded country house about two miles up the Kilmarnock Road from the village of Monkton …*
>
> *I was on watch when the raid developed over Clydebank and Greenock. Group ordered a 'fighter night' by which a block of the atmosphere above the target area, and above a prescribed height, was allotted and reserved for the fighters, so we just sent all the night fighters we had* (MacLean, 1999: 130-131).

As mentioned by S/Ldr MacLean, shortly before midnight on 5 May, it became apparent that a concentrated attack was about to be made on Clydeside. Plans were made with the approval of the Air Officer Commanding No 13 (Fighter) Group, Air Vice-Marshal John Andrews, who was present in the Operations Room at Rosemount at the time, to use Boulton Paul Defiants for controlled interceptions on the bombers' approaches and return. In addition, the AOC gave approval to operate a 'Fighter Night' over Glasgow between 1am and 2am on 6 May, when day fighters and any free night fighters would patrol at predetermined heights over the city. The first Defiant, from No 141 Squadron, was airborne at 11.30pm on 5 May, the second took-off at 12.04am on 6 May followed by a third 4 minutes later. The first Supermarine Spitfire, from No 602 Squadron, took off at 12.28am, followed by the fourth and fifth Defiants at 12.37am and 1.06am respectively. A second Spitfire was airborne at 1.10am and a third ten minutes later. The second Defiant, piloted by Sergeant Laurence, shot down a Heinkel

He 111 at 1.44 am a few miles south-west of Glasgow, although the aircraft reached the outskirts of Newcastle-upon-Tyne before crashing. At approximately the same time the fifth Defiant, flown by Flight Lieutenant Wilson, spotted a Heinkel He 111 at 13,000 feet over Glasgow, and this was also shot down. These were the first two 'kills' achieved by Ayr Sector (TNA, AIR 28/40).

Another mass attack on Clydeside, this time focused on Greenock, took place on the night of 6/7 May. Under Ayr Sector control, Defiants and Spitfires took off from 12.16am on 7 May, the last Defiant getting airborne at 2.44am. Further successes were achieved, with three aircraft claimed destroyed and one damaged. Squadron Leader Wolfe flying a Defiant engaged a Junkers Ju 88 at 12,000 feet over Glasgow and shot it down, the aircraft crashing near Lennoxtown. Flight Lieutenant Wilson in another Defiant attacked a Heinkel He 111 near Ayr and shot it down in flames. A third aircraft was also claimed by F/Lt Wilson, shot down with its starboard engine and cockpit on fire, which crashed into the sea. Sergeant Brown flying a Spitfire attacked and damaged a Heinkel He 111 (TNA, AIR 28/40).

Squadron Leader MacLean recalled another incident he was involved in:

> *On 10th May 1941 … the Ayr sector became briefly involved in one of the strangest events of the Second World War … During the six to midnight watch, about half past ten, to my surprise a 'hostile' appeared on our plotting table in the vicinity of Selkirk flying* [to] *the west. The Ops Room sprang into action. Fortunately we had two Defiants fully armed airborne practising with their AI* [Airborne Interception radar]. *I got them on the RT* [Radio Telephone] *and told them to orbit Kilmarnock which seemed to lie in the path of the hostile.*
>
> *I then phoned the Controller of the Royal Observer Corps centre in Ayr and asked if he had an identification. To my surprise he answered "Yes, it is an Me 110." My heart sank - another cock-up for sure. "Better tell your chaps to have another look" I said. "If it's an Me 110 it does not have enough petrol to get back to Germany." This was a tricky situation for the Controller, I had to warn the Defiants that doubt had arisen whether it was hostile. There was very little ROC cover over the Southern Uplands. The night was falling fast. No further plots appeared and no further sightings were reported.*
>
> *About an hour later the phone buzzed. Ops B answered. "It's a Police Sergeant wants to speak to you Sir, from Eaglesham Police Station, I think," he said. What an extraordinary evening! "Yes Sergeant what is it?" "We have a German Captain here at the police station, he has landed by parachute. He says he wants to see the Duke of Hamilton" "That's odd, can he identify himself." "No Sir, he won't say any more." "All right Sergeant I will deal with it. We'll let you know."* (MacLean, 1999: 137-138).

This was the arrival of Rudolf Hess, Deputy Führer of Nazi Germany, in Scotland. No 34 Observer Group at Glasgow, and in particular the Assistant Observer Group Officer there, Major Graham Donald, played a key role in these events.

At 1.42pm on 28 May 1941 Red Section of No 43 Squadron were scrambled by Ayr FSHQ to investigate Raid X167 (TNA, AIR 28/40). The raid entered Ouston Sector from the west near Dumfries at approximately 2pm. Green Section of No 72 Squadron were vectored from Acklington towards the raid (TNA, AIR 28/624). However, by that time it had been intercepted by 43 Squadron, identified as hostile and shot down (TNA, AIR 28/40). The enemy aircraft was a Junkers Ju 88 on a photographic reconnaissance mission to Glasgow and shot down by a Hawker Hurricane flown by Flight Lieutenant DL Du Vivier. The Ju 88 crashed near Riccarton in Roxburghshire, with two crew killed and two baled out and taken prisoner (Ramsey, 1990: 36).

On 21 May 1941 63rd Anti-Aircraft Brigade Headquarters moved from Henderson Church Hall in Kilmarnock to Rosemount House, re-opening there at 2.30pm, and consequently was co-located with Ayr SOR (TNA, WO 166/2316). The Brigade HQ remained at Rosemount House until 21 February 1942, when it moved out to 'The Craig' at Gatehead, Kilmarnock (TNA, WO 166/7420).

For the remaining two years that Ayr Sector remained operational, from May 1941 until May 1943, there were prolonged periods with no operational flying from Ayr, but most of the operations controlled by Ayr FSHQ comprised convoy escorts or unidentified raids which, upon investigation, turned out to be friendly aircraft. The only exception was on the morning of 25 March 1943 when enemy aircraft were in the vicinity of Ayr from 12.15am. Two Bristol Beaufighters of No 488 Squadron took off at 12.23am and 1.08am respectively, but made no contact with the raiders. There was widespread bombing in the Sector, with a bomb dropped east of Kilmarnock at 12.40am and another two miles south-east of Glasgow five minutes later. The ROC reported bombs dropped in the sea south of the Mull of Galloway at 1.24am and another bomb five or six miles north-west of Glasgow at 2am. A report was received by Kirkcudbright Police Station at 8.06am that at 12.45am a German bomber had crashed at Carsphairn Farm and was destroyed by fire (TNA, AIR 28/40).

On 4 November 1941 the Watch Establishment for the Sector Operations Room at Ayr was set by Headquarters Fighter Command as:

Supervisor	1 Sergeant
Deputy Controllers	2 Sergeants
Ops A	1 Aircraftman
Ops B1	1 Aircraftman
ROC Liaison Teller	1 Corporal
Bomber Plotters	2 Aircraftmen
Fighter Plotters	2 Aircraftmen
Triangulator Teller	1 Corporal
Triangulator Setters	3 Aircraftmen

ROC Plotters	8 Aircraftmen (Glasgow, Ayr, Galashiels, Dunfermline, Oban, Carlisle, Lancaster, Dundee)
Fighter Table Plotter/Tellers	3 Aircraftmen (Turnhouse, Ouston, Andreas)
Fighter Table Supervisor	1 Corporal
RDF Plotters	2 Aircraftmen (plotting positions from HQs 9 and 13 Groups)
GCI Plotters	2 Aircraftmen (St Quivox, Genoch)
GCI Liaison	2 Corporals
Sector Fighter Plotter	1 Aircraftman
Messengers	2 Aircraftmen (Aircraft Hands)
NCO in charge	1 Flight Sergeant
NCO Assistant	1 Sergeant
Tracer	1 Corporal
Clerk General Duties	1 Aircraftman (TNA, AIR 2/3546).

On 24 August 1942 it was noted that the name Rosemount was no longer used in correspondence for the FSHQ. Instead, going forward, it would be known as No 14 Site, RAF Station, Ayr (TNA, AIR 28/40). At 8am on 10 May 1943 Ayr Sector closed and was amalgamated into Turnhouse Sector (TNA, AIR 25/233). Rosemount House was transferred from RAF Ayr to No 105 (Combined Operations) Wing Headquarters (TNA, AIR 16/675).

Ayr

Unit	Observer Centre
Region	South Ayrshire
NGR	NS 3386 2187 (Masonic Hall, Nile Court, Ayr)
NMRS	NS32SW 562
In use	18 November 1940 – 12 May 1945

Unit	Emergency Centre
Region	South Ayrshire
NGR	NS 3353 2213 (Academy Hall, Ayr)
NMRS	NS32SW 184

On 22 July 1937 the Home Defence Committee recommended the adoption of certain proposals, including the formation of No 33 Observer Group covering Wigtown and the Kirkcudbright district. One week later, the Committee for Imperial Defence ruled that the necessity for establishing No 33 Group was to be reviewed 12 months later. This was done by the Air Ministry and Home Office in August 1938, who noted that Wigtown lay at the extreme range of bomber aircraft then in service with the German Air Force, a situation which would not be materially altered even if German bombers were able to operate from airfields in the Low Countries. This, combined with the fact that there were no vital points in the areas that were considered worthwhile bombing targets, meant that it was

47 Ayr Centre personnel, taken outside the Centre in Nile Court. Observer Commander John Kennedy, Group Commandant from 1943 until 1945, is third from left in the middle row (© No 25 Group ROC Association).

concluded there would be no reason for German bombers to operate in the area. It was therefore considered that the formation of No 33 Group was unnecessary. It was noted that should the range of German bombers increase, they might pass through the Kirkcudbright area en route to targets in Northern Ireland or in an attempt to outflank the air defences, but this was impractical in 1938 (TNA, AIR 2/1772).

Air Vice-Marshal Richard Peirse, Deputy Chief of the Air Staff, and Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command, both agreed with the decision not to proceed with the formation of No 33 Group at that time, with Dowding noting on 12 August 1938 that it might never be needed and that it was quite likely that inland radar would take

over the function of the proposed Group. Even as late as 9 November, the Home Office Air Raid Precautions Department agreed (TNA, AIR 2/1772).

However, despite the previous reservations, No 33 Observer Group was formed in 1940 (Wood, 1992: 267), becoming operational on 18 November 1940 (TNA, AIR 16/50) with the Observer Centre located in Nile Court (Wood, 1992: 267), in the hall of Masonic Lodge No 204 (Valuation Roll, Nile Court, 1940-41). The Hall was designed by Henry Vincent Eaglesham and built in 1895-96 (Close & Riches, 2012: 143).

Selection of sites for Observer Posts in No 33 Group began in February 1939 (TNA, AIR 2/20046, AIR 2/20047, AIR 2/20055, AIR 2/20067) with another wave of sitings started in August 1940 (TNA, AIR 2/20056, AIR 2/20057, AIR 2/20058, AIR 2/20059, AIR 2/20060, AIR 2/20061, AIR 2/20062, AIR 2/20063, AIR 2/20064, AIR 2/20065, AIR 2/20066).

The Controller of No 33 Group was Alex McHarg (Wood, 1992: 267). From 1940 until circa February 1941 the Observer Group Officer was Colonel F Rainsford Hannay, and from circa February 1941 was Sir James Reid Kay (TNA, AIR 2/20056). Ayr Group also had the distinction of having as one of its Deputy Controllers, Observer Officer James D Pollock, VC (Winslow, 1948: 289; Ross, 1995: 48, 96), believed to be the only member of the ROC ever to hold the Victoria Cross. He was awarded his VC for conspicuous gallantry in defending the Hohenzollern Redoubt during the Battle of Loos on 27 September 1915 (Ross, 1995: 48).

The Observer Posts within No 33 Group were as follows:

A.1	Sanquhar	NS 784 105 (Nov 1940 – May 1945)
A.2	Thornhill	NX 884 940 (Nov 1940 – May 1945)
A.3	Auldgirth	NX 916 873 (Nov 1940 – May 1945)
A.4	Moniaive	NX 769 902 (Nov 1940 – May 1945)
B.1	Dalry	NX 625 821 (Nov 1940 – May 1945)
B.2	Kirkgunzeon	NX 870 669 (Nov 1940 – May 1945)
B.3	Parton	NX 689 704 (Nov 1940 – May 1945)
C.1	Castle Douglas	NX 769 622 (Nov 1940 – May 1945)
C.2	Rockcliffe	NX 857 527 (Nov 1940 – May 1945)
C.3	Kirkcudbright	NX 698 503 (Nov 1940 – May 1945)
C.4	Gatehouse of Fleet	NX 607 563 (Nov 1940 – May 1945)
D.1	Creetown	NX 481 567 (Nov 1940 – May 1945)
D.2	Garlieston	NX 465 466 (Nov 1940 – May 1945)
D.3	Port William	NX 343 430 (Nov 1940 – May 1945)
E.1	Bargrennan	NX 353 764 (Nov 1940 – May 1945)
E.2	Newton Stewart	NX 404 654 (Nov 1940 – May 1945)
E.3	Kirkcowan	NX 327 610 (Nov 1940 – May 1945)

F.1	New Luce	NX 177 661 (Nov 1940 – May 1945)
F.2	Auchenmalg	NX22735178 (Nov 1940–May 1945)
F.3	Sandhead	NX 095 506 (Nov 1940 – May 1945)
G.1	Ballantrae	NX 091 827 (Nov 1940 – May 1945)
G.2	Ervie	NW 990 690 (Nov 1940 – May 1945)
H.1	Turnberry	NS 211 059 (Nov 1940 – May 1945)
H.2	Barr	NX 274 931 (Nov 1940 – May 1945)
H.3	Barrhill	NX 222 817 (Nov 1940 – May 1945)
J.1	Prestwick	NS 344 251 (Nov 1940 – May 1945)
J.2	Joppa	NS 419 195 (Nov 1940 – May 1945)
J.3	Dunure	NS 263 162 (Nov 1940 – May 1945)
K.1	New Cumnock	NS 615 133 (Nov 1940 – May 1945)
K.2	Carsphairn	NX 563 934 (Nov 1940 – May 1945)
K.3	Straiton	NS 381 043 (Nov 1940 – May 1945)
K.4	Dalmellington	NS 479 055 (Nov 1940 – May 1945)

(TNA, AIR 2/20050, AIR 2/20052, AIR 2/20053, AIR 2/20055, AIR 2/20056, AIR 2/20057, AIR 2/20058, AIR 2/20059, AIR 2/20060, AIR 2/20061, AIR 2/20062, AIR 2/20063, AIR 2/20064, AIR 2/20065, AIR 2/20066, AIR 2/20067, AIR 2/20068; Wood, 1992: 323, 324-327, 329, 335).

The Ayr Group, and No 32 (Carlisle) Group performed an important function with the rise in importance of Prestwick Airport as the eastern terminus of the transatlantic air bridge. Both Groups did valuable work in tracking US aircraft heading south and south-east. The high degree of efficiency achieved by crews at Ayr Centre was largely due to the training of Observer Officer Thomas Cant, a retired schoolmaster. He was awarded an MBE for his services (Winslow, 1948: 189).

The new position of Group Commandant was created in 1943 and that of Observer Group Officer deleted. The Group Commandant for No 33 Group from 1943 to 1945 was Observer Commander John Kennedy (Wood, 1992: 267), who had until that point been OGO with No 34 Group at Glasgow (TNA, AIR 2/20039, 2/20319).

Ayr Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Bearsden

Unit	Sub-Gun Operations Room
Region	East Dunbartonshire
NGR	NS 5404 7176 (Melfort House)
NMRS	Not allocated
In use	25 May 1942 – 1 March 1943

Bearsden was 'B' Sub-GOR of the Clyde GOR at Aikenhead House, and was located at Melfort House, 6 Ledcameroch Crescent (TNA, WO 166/7399). The location for the Sub-GOR at Melfort House was decided upon on 16 March 1942, and opened on 25 May, with telephone lines to Clyde GOR, 'A' and 'C' Sub-GORs and gun sites N3, N4, N5, N9 and CZ1 (TNA, WO 166/7371).

Melfort House was built before the First World War by William Elphinstone Fleming, a manufacturer (Valuation Roll, Melfort House, 1915-16) but by 1920 was empty although still owned by Fleming (Valuation Roll, Melfort House, 1920-21). By 1925 it had been bought by Isidore Cohen (Valuation Roll, Melfort House, 1925-26), who still retained ownership in 1930 (Valuation Rolls, Melfort House, 1930-31). By 1935 the property was owned by Kilmardinny Estate and occupied by Mrs Jane SRW Thomson, this remaining the case in 1941 (Valuation Roll, Melfort House, 1935-36 and 1940-41).

'B' Sub-GOR closed down on 1 March 1943 (TNA, WO 166/11216).

Benbecula

Unit	Sub-Sector Operations Room (FSHQ and Sub-Filter Room (planned))
Region	Benbecula
NGR	NF 7791 5546 (Ops Block, Air Ministry Drawing No 18767/40)
NMRS	NF75NE 4
In use	circa 1942 – circa 1945

In 1940 it was anticipated that there would be a need for a forward fighter base for the air defence of the Western Isles (Smith, 2016: 30) and consequently an Operations Block for a Fighter Sector was built at Benbecula, to Air Ministry Drawing Number 18767/40 (RAF Museum, Benbecula Record Site Plan Site No 1 Airfield, Drawing Number 4852/44). However, plans for the Fighter Sector were never fulfilled and instead Benbecula opened as a Coastal Command airfield in 1942 (Smith, 2016:30).

Benbecula was intended to operate as a Sub-Filter Room, receiving plots from Borve Castle CHB radar station on Benbecula by telephone and Greian Head CHL radar station on Barra by R/T. These plots were to be filtered before being passed to Inverness Filter Room by teleprinter (TNA, WO 199/534). However, when Greian Head became operational on 3 April 1942, it passed its plots via landline to Tiree SFR. Borve Castle became operational in August 1942, but it passed plots on a temporary line to Stornoway SFR (TNA, AIR 26/103). There is no record of any radar station sending plots to Benbecula and hence it appears the planned Sub-Filter Room there never came into operation. No documentary evidence for the role of the FSHQ has been found but it was definitely operational and manned and it is assumed that it was operating as a Sub-Sector Operations Room within the Stornoway Sector.

48 Sub-Sector Operations Room at Benbecula (J Ayers via Mike Hughes).

Bentley Priory, Stanmore

Unit	Fighter Command HQ Operations Room
Region	Harrow
NGR	TQ 1547 9327 (Bentley Priory ground floor)
In use	June 1936 – 9 March 1940

Unit	Fighter Command HQ Operations Block
Region	Harrow
NGR	TQ 1568 9327 (underground Operations Block)
In use	9 March 1940 – April 1968

Unit	Fighter Command HQ Filter Room
Region	Harrow
NGR	TQ 1547 9327 (Bentley Priory lower ground floor)
In use	8 November 1938 – 20 May 1939

Unit	Fighter Command HQ Filter Room
Region	Harrow
NGR	TQ 1548 9328 (Bentley Priory ground floor)
In use	20 May 1939 – 9 March 1940

Unit	Fighter Command HQ Filter Room
Region	Harrow
NGR	TQ 1568 9327 (underground Operations Block)
In use	9 March 1940 – 5 August 1943

In 1926 the Air Ministry purchased 40 acres of the Bentley Priory estate and on 26 May the HQ of Inland Area of the Air Defence of Great Britain (ADGB) moved into Bentley Priory. On 14 July 1936 ADGB was split into Fighter Command and Bomber Command (Brooks, 2014: 7), with the headquarters of the latter moving to Hillingdon House, Uxbridge in north London (Sturtivant, 2007: 79). A temporary operations room was established in the ballroom in the Priory in June 1936 at a cost of £500 (Air Ministry, 1952: 29) and from July 1937 this received radar information from Bawdsey filter centre (Air Ministry, 1952: 23) until Stanmore Filter Room was established in the basement of the Priory on 8 November 1938 (Wood with Dempster, 1990: 89; Brooks, 2014: 8).

It was decided on 23 September 1938 that a permanent underground Operations Block was to be built at Bentley Priory, including accommodation within the block for a filter room. The cost was not to exceed £45,000 (Air Ministry, 1952: 30). Work started in January 1939 and 58,000 tons of earth were removed with the depth of the excavation reaching 42 feet. During this time, one of the workmen fell up to his waist in the mud at the bottom of the excavation and was unable to extricate himself. A crane was used to lift him to safety, but it pulled him out of the mud minus his trousers. A total of 17,000 tons of reinforced concrete was used in the construction of the underground block (Ramsey, 1980: 15) and the Operations and Filter Rooms became operational there on 9 March 1940 (Air Ministry, 1952: 42).

Joan Clarke (Crawford) from Liverpool was posted to Bentley Priory in December 1939 as a Filter Room Plotter:

> *I'll never forget my first sight of Bentley Priory; passing through huge ornate gates supported on each side by beautiful pillars, then driving on down the long curving drive to finally catch sight of the old house. We were all lined up outside what looked like the stables and were greeted by a WAAF Officer, the formidable Section Officer McLeod. The Liverpool contingent, plus a few others, was assigned to 'C' Watch and we were driven to our billet. This was 'The Warren', a lovely country house not far away in Bushey Heath, opposite St Peter's Church …*
>
> *We were given our Watch duties which were spread over twenty-four hours, and were four hours at a time. We went on at midnight 00.01 hours, then had eight hours off, and returned at 12 noon until 4 o'clock in the afternoon. This*

was followed by a further eight hours off, then we started the routine again at midnight. The following week it changed to 4am to 8am and 4pm to 8pm, and so on. It seemed to be all bed and work and, when you were going on at 4am, it meant you had to get up at 3am to be in time for 'Phoomph', our name for the coach. Thankfully our duty times included one week of eight hour shifts, which ran from midnight to 8am, a great relief because you could if you wished occasionally sleep all day outside in the sun, go to a dance in the evening, maybe at Watford Town Hall, then catch the last bus back to Bushy and go straight on duty.

Life in the early days was easy as there was little to do; it was a time of waiting. I have never written so many letters or read so many books. I read Gone with the Wind *in about a week. People around the Filter Room table would be knitting or doing crosswords, etc. Occasionally someone would happen to cast an eye up at the balcony and notice dear old 'Stuffy' Dowding was peering down at us. We would give each other a nudge and immediately the knitting, writing and books would disappear. I'm sure he must have inwardly chuckled seeing our reaction; no-one knew how long he had been standing there. It was a very relaxed atmosphere; you spoke to the people at the radar station you were covering every fifteen minutes to check that the telephone line was in working order; it should have been every five minutes. Their shift times were different from ours so that continuity could be maintained. We got to know them very well and would discuss everything under the sun - hobbies, pastimes, state of the weather, anything that came to mind. Quite suddenly things would change. The voice at the other end would say "Hang on, we've got something showing on the screen. Something is coming up. Standby. The plot reads V Victor 8565." This I repeated as a check then placed a counter on that position on the table. I asked, "Have you got a height and number of aircraft?" The Filter Officer on the balcony wanted to know and it went on the raid plaque. More plots came through; the track continued.*

By the time the war hotted up, we were well set in a routine. All our Watch lived at 'The Warren' and 'Phoomph' regularly took us to the Priory; later, when the summer weather was nice, during the day, we walked. Camouflage netting covered the Operations Block area even though it was underground. Showing of identity passes became almost unnecessary when our faces became familiar. Dim blue lights lit up the many steps of the passageway down to the Operations centre. All was quiet inside as we walked along the corridor; doors along there never seemed to open. By contrast, when entering the Filter Room, you were struck by the noise and twenty-eight members of our Watch moving in to take over didn't help. People on the balcony would be talking with the Filterers beneath then at the table, perhaps querying or altering details of a track, etc; it all added to the general hubbub. Other voices: WAAFs speaking to their radar stations and 'Tellers' reading off the plots showing on the table to Operations Rooms throughout the country.

49 Temporary Filter Room at Stanmore (Bentley Priory), circa February 1940 (© Historical Radar Archive).

50 Underground Filter Room at Stanmore (Bentley Priory) taken on 10 September 1945 (© Imperial War Museum London CH16286).

When taking over there was a well practised procedure. Plotters selected from the rack a telephone headset and mouthpiece which was hung around the neck. WAAF Sergeant Harland had a list of radar stations from which she selected the one you were to man; after a while this became almost a formality. I usually had Ventnor on the Isle of Wight, and would just say "Ventnor" and she would confirm (my first station was Kirkwall up in the Orkneys). I would walk to the table, sit down beside the girl working on Ventnor, plug my headset into a duplicate socket, listen in to check that the line was in order, then if all was well she unplugged her headset and departed. This procedure ensured that there was no break in continuity; no plots were lost. If we were not busy, I would make a friendly remark like "Is there much on?" and she would have a quick word and then go (Flint, 1996: 118-120).

Margaret Taylor (Doll) was a Clerk SD (Special Duties) Sergeant, working as a Plotter in the Fighter Command Operations Room:

The first thing you did when arriving on duty was to have a good look at the table to see what was going on. Each Plotter collected her headset, put it on and plugged it into her position at the table. On the hour and every quarter hour the Filter Room Teller next door would call "Colour change red," and then go through all the stations on her lines; for example, if it were No 11 Group area, it would be Uxbridge (Group) and the Sector Stations at Tangmere, Kenley, Biggin Hill, Northolt, Hornchurch, North Weald, Debden; this procedure was to check their phones were serviceable; the Plotters there each answered to their station's name (when extremely busy this was dispensed with and check made only when a small lull in activity occurred).

Each of our Plotters had a rod with a battery-operated magnetic tip and also at the table edge a small tray filled with red, yellow and blue metal arrows which were approximately ¾ inch long. There were also numbers and letters for track details: red letter H for 'Hostile', black X for 'Unidentified', F for 'Fighter' and C for 'Coastal' (aircraft of Coastal Command). These pieces fitted on to small plaques (not magnetic) to make up the track number, height and number of aircraft. The plaques were positioned at the head of tracks and moved using a small stick.

At 1207 hours, say, a track might appear near the French coast and the Teller in the Filter Room would commence giving information for the first plot, starting with the track designation (eg 'Unidentified', and its allotted number), the direction of flight and the grid letter and four figure grid position. This was followed by the number of aircraft and their height. She would say, for example, Raid X49 - North West - A 3752 - ten aircraft at 10,000 feet. The Plotter then looked at the colour clock on the wall and seeing the hand was in the yellow section, picked up a yellow arrow, laid it on the table in front of her pointing North West and picked it up on the end of the rod by activating the magnet, then placed it with its point on the given map position, and released it. With practice,

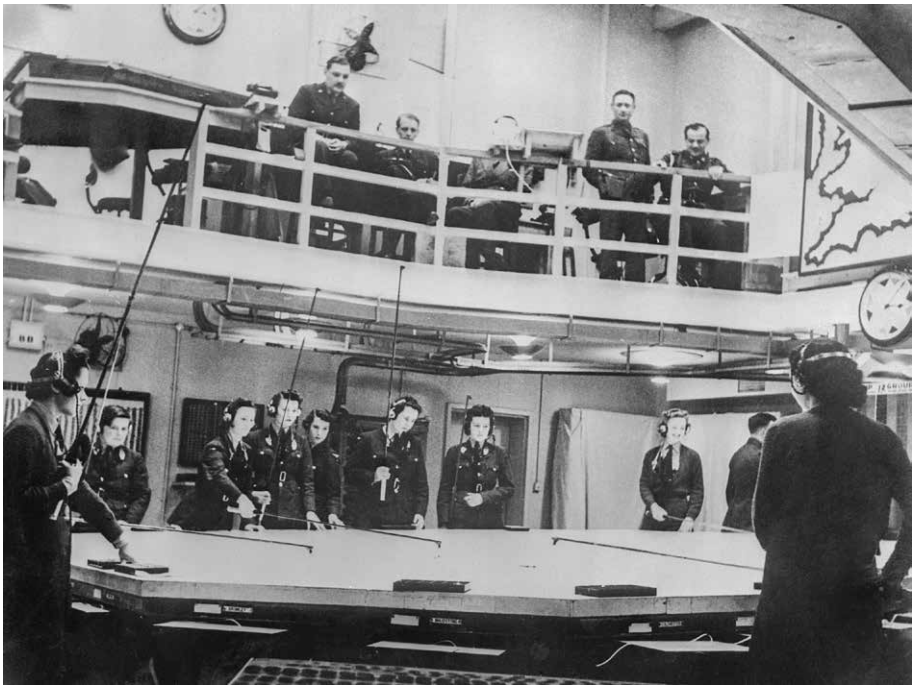
you could develop a very quick rhythm, make up a plaque and be ready waiting for the next plot. A large group of aircraft that could not be counted individually would be estimated at, say, 30+, or whatever. If activity were very hectic then two Plotters could plug into the same line and share the work; at such times as many as ten Plotters could be seen at the table, including those receiving Observer Corps information. Only hostile or 'doubtful' overland Observer Corps plots were passed to us from Group. Chatting to the Teller was not encouraged, but we might on occasions ask whether there was "any height available yet" or if the aircraft was using IFF. We could be getting plot positions of the tracks of all aircraft and you could on occasions see raids coming in and our fighters going out to meet them; in every instance the plot colour was matched to that specified on the face of the clock. Old plots of a particular colour were taken off when the hand of the clock moved into the same colour section of the next quarter; this meant that none of the information displayed on our table was more than ten minutes old. Our two Tracers in the gallery near the Controller, used two map boards over which sheets of tracing paper were laid and they drew all the tracks plotted on the Operations Room table. They too changed their colours to coincide with the clock by using coloured pencils; the times were recorded also. As I remember, the tracing was changed to a fresh one every hour during busy periods. These tracings were a permanent record that could be referred to later (Flint, 1996: 125-126).

June Esau (Clapperton) served in the Air Raid Warning Section of the Operations Room in 1941:

On the balcony the ARW [Air Raid Warning] *table was a large map of the country lit from below. When an ARW 'Yellow' was given to a particular district, a yellow light from beneath illuminated that part of the map. To the Police and Fire Services of that district our telephonists sent preliminary warning of the impending raid through operators at the civilian telephone exchanges. If the raiders continued on course this would become ARW 'Red' (full alert and sirens sounding), but it occurred only after we established that none of our own aircraft was due back from a raid, or a returning reconnaissance flight was the object of our concern. From the balcony we watched the tracks relayed from the Filter Room forming on the Operations Room table, and acted upon them. The Filter Room housed the Movements Liaison Section (MLS) and their job was vital; they had all the information about our aircraft crossing the coast; their outward flight times and when they were expected to return (ETA* [estimated time of arrival]*), also numbers of aircraft involved. They were aware of what height the squadrons or sections would be when crossing the coast. Using this knowledge, they were able to work out where our aircraft would be at a given time and assess whether tracks on the table were of hostile aircraft or not.*

If the CH or CHL radar stations picked up a single aircraft coming in and we were not expecting anyone, it was possible that it could be one of ours in trouble and we would expect the pilot to switch on his IFF. This was a device in the aircraft which, when switched on, would flash through the blip it was making

51 Temporary Operations Room in Bentley Priory, 14 February 1940 (© Crown Copyright Royal Air Force Museum).



52 Underground Operations Room at Bentley Priory (© Imperial War Museum London C1869).

> *on the screen of the radar stations every 6 seconds. So you got the V-shaped blip of the aircraft and the extra flash down and up of the IFF blip making the V elongated for a second. Sometimes the pilots were naughty and forgot to switch it on; this resulted in an 'X' being put on the raid plaque which signified it as 'doubtful' (Unidentified). The Observer Corps obtained visual identification and their information was wonderful for sorting out what the aircraft was and often prevented the ARW 'Red' being given. The reason for not sounding the sirens at the drop of a hat was because the factories in the areas concerned would be shut down and only re-start once the 'All Clear' was given; this was shown as ARW 'White'. If a large number of aircraft were approaching and we had fighters up, they helped by transmitting back a warning. A huge illuminated ARW map of the whole country was on the wall north of the plotting table which also showed the yellow and red warnings for everyone to see. 'All Clears' were usually given after enemy aircraft had crossed the coast going home* (Flint, 1996: 130-131).

Fighter Command Emergency Operations Room was established at Leighton Buzzard to protect against damage to HQFC at Stanmore. An Emergency Filter Room was also built and, in order to allow this to operate if Stanmore was put out of action, six linking circuits to Stanmore were provided (Air Ministry, 1958: 52). Although the Emergency Operations Room was not required, it was used to train WAAF plotters (TNA, AIR 2/4812). The Emergency Filter Room was transferred to No 26 (Signals) Group in June 1943, allowing teleprinters to be moved there from the Corn Exchange in Leighton Buzzard (TNA, AIR 2/4813).

On 5 August 1943 the Filter Room, used as No 11 (Fighter) Group Filter Room, was moved from the underground Operations Block at Bentley Priory to a new underground Filter Block (HRA, No 60 Group RAF Bulletin, August 1943).

Carlisle

Unit	Observer Centre
Region	Cumbria
NGR	NY 4001 5573 (Huntington's underground stables, West Walls, Carlisle)
In use	20 December 1939 – 1941

Unit	Observer Centre
Region	Cumbria
NGR	NY 3919 5491 (10 Norfolk Road, Carlisle)
In use	1941 – 12 May 1945

Unit	Emergency Centre
Region	Cumbria
NGR	NY 4008 5569 (Central Hotel, Carlisle)

No 32 Observer Group was formed circa July 1939 (TNA, AIR 25/232) and manned and in operation from 2pm on 20 December 1939 (TNA, AIR 16/49).

The Observer Centre was located in the underground stables of Huntington's in West Walls (Wood, 1992: 269). The company of David J Huntington, which advertised in 1931 as "funerals furnished with Belgian Horses, Motor Hearses" (CAC, Carlisle Directory, 1931) was located at City Mews Garage in Head's Lane, just off West Walls (CAC, DX 2010/1), and it seems logical that the company's stables were redundant or little used by that time. It was used as the Observer Centre until 1941, when it moved to 10 Norfolk Road (Wood, 1992: 269). The Controller was Colonel FRW Graham and the Observer Group Officer Brigadier Pringle (with headquarters in Bank Street, Carlisle) (Wood, 1992: 269).

Hubert Ware was an Observer Officer at Carlisle Centre and he recalls:

I recall 32 Group was formed in some haste in the autumn of 1939. I was pressed into joining by my next-door neighbour, as a part-timer, and we opened for business around Christmas 1939 and I became a full-timer at some point in 1940. In those early days Posts and Centre were under separate command which I presume was to speed things up and get things going …

The Centre was under the supervision of Colonel FRW Graham who was a typical 'between the wars' Colonel who would persist in rushing into things without thinking them over first. Still, we did have a certain amount of sympathy for him. He had been sent out in charge of the Shanghai Defence Force [in fact he commanded the Shanghai Volunteer Corps, not the SDF (*Belfast News-Letter*, 24 January 1938)] *and was more or less promised a promotion to Brigadier on his return. In the event, on his return, he, along with some others, was called to the War Office and given marching orders. The reason given by the then War Minister was "acceleration of younger Officers."*

Colonel Graham had his office at 55 English Street with the Centre in West Walls in what had been a Funeral Stables. One descended from street level down a steep flight of stairs to the rest room, which had only one window high up, and where the lights were kept on day and night. This led into the plotting room, where there were windows, which had been used by the previous owners for manufacturing purposes, coffins etc. The only heating was by electric panel heaters, placed half way up the walls for some reason, which meant that if your head was warm your feet were cold! The next room was where the horses had been kept and, at times, the 'pong' was pretty bad, at least at the start. One got used to it in time.

In the early days there were seven crews, those who were full-time being in crews 1 and 4 who had Bernard Ashman as Controller. Crew 2 had Roy Hanson as Controller, Crews 3 and 6 had George Watson, Crew 5 Claude Metcalfe, Crew 7, who were all part-timers, had Cecil Bowie.

In the rush to get things going they advertised for applicants as well as getting the Labour Exchange to send people along. There was no vetting of people's backgrounds in those days. Folk were sat down at the plotting table with a head

set on and, if you could read the numbers on the table and hear what was said over the earphones, you were IN. At the start the rate of pay was 1/3d (nearly 7p in today's money) an hour and 10 bob (50p) for an eight-hour night shift. In the early days we had several members around 70 yrs old and one charming old man who claimed to be 75. Those days were spent in finding where the numbers were on the plotting table, using Halma Men (pieces from an old board game called Halma) for the plots. These were replaced, eventually, with metal shields and arrows.

On a raised platform above the plotting table was situated a reader who kept a record of all our tracks on a paper map and, up to two inter centre tellers who passed on tracks leaving the Group. They also received details of tracks approaching which they wrote down on paper slips. The amount of paper used was colossal. There was also a main teller linked to the RAF (13 Group, Kenton Bar, Newcastle) passing on any tracks they required. We also had links, in the early days, to Leeming and Turnhouse RAF sectors.

At some point in 1940 Roy Hanson was given the job of forming an Air Raid Warning Team in the centre. It had been realised that warnings issued to the public were covering, through necessity, large areas at a time. Factories were losing production so a scheme, which gave various works direct lines to centres, was introduced to enable them to continue production until the threat of an attack became close. They could then drop everything and take to the shelters. Our Group, in due course, had a large number of customers which included RAF airfields, Maintenance Units, Workington Steel Works and many more. One interesting customer was the CDL [Canal Defence Light] *School at Lowther who used to have tanks, fitted with powerful search lights, roaring up and down Lowther Park for hours at night. One could see the lights from many miles away.*

Colonel Graham was convinced the centre would be attacked by saboteurs so had the entrance covered by sandbags with an armed sentry on duty. This continued until one Saturday night when the sentry fired at "something" in the street. It was realised the danger to the public was greater by having an armed sentry than from saboteurs. So, after that incident, the sentry had just the rifle with bayonet. I can tell you, it did not pay to walk quietly down West Walls at night.

When women finally came along (1941) it was realised that conditions in West Walls were completely unsuitable, toilet facilities being pretty basic to say the least, so an empty house in Norfolk Street was requisitioned by the Air Ministry. Two rooms were knocked into one and, for a time, we had a super Ops Room. Colonel Graham composed a motto for one of the walls. It went something like this:

MAY WE SERVING KING AND EMPIRE KEEP WATCH EFFICIENTLY. BY OUR VIGILANCE WE ASSIST IN DESTROYING THE ENEMY AND SAVE THE LIVES OF OUR AIRMEN.

He was very proud of this and all visitors had to be shown it. He was not best pleased when he was told, one day, that the word efficiently had been spelt wrongly. A painter had to be sent from 14 MU to alter the spelling. In those days every little thing had to be done by people from 14 MU. If a lamp from the ops room failed two men had to come from 14 MU. One held the steps, one replaced the lamp. Trade Union rules (apparently)!

I do recall a worse incident though! Colonel Graham ordered 6 toilet rolls from 14 MU as he was not allowed to buy anything in the town. I remember going on duty (this would be 1940) to find a large lorry blocking West Walls whilst the poor driver tried to find someone to sign for the delivery. Not long after that the sandbags were removed.

When Geoff Ambler became Corps Commandant he ordered all Ops Rooms were to be of one standard design so there were a lot of alterations made at Norfolk Road. In 1943 orders came through that each crew had to have a doorman responsible for door security and odd jobs like sweeping up, emptying ash trays etc.

Colonel Graham was now Observer Commander Graham in charge of the whole Group following health problems for Brigadier Pringle who had collapsed whilst visiting his mother in St Boswell. He began sending letters direct to HQ ROC on any matters he disagreed with. It would not have been too bad if he had sent his protests to Area HQ but he insisted on going straight to the top. The final straw came when the cleaning lady left for another job with more pay being offered. The Labour Exchange could not find a replacement for the pay offered so Colonel Graham, I believe, sent a real stinker of a letter to Bentley Priory. Shortly afterwards he was 'retired'. This was 1944 and a new GC arrived, from outside the group, whose name was Rowlands.

In 1944 the Duty Controllers were made up to Observer Officers and 'divorced' from the crews. This meant there would be four of us. Messer's Ashman, Thompson, Bowie and yours truly! Things went on thus until the end of the war. Norfolk Rd was eventually returned to its owners with, I imagine, some compensation for the damage caused by the alterations (Hubert Ware, via ROC Association 22 Group History Project).

The Observer Posts within No 32 Group, were as follows, with those Posts in Scotland marked with an asterisk:

A.1	Steele Road*	NY 518 935 (Dec 1939 – May 1945)
A.2	Roadhead	NY 519 748 (Dec 1939 – May 1945)
A.3	Liddesdale*	NY 476 878 (Jun 1940 – May 1945)
B.1	Kielder	NY 627 928 (Dec 1939 – May 1945)
B.2	Bellingham	NY 847 838 (Dec 1939 – May 1945)

B.3	Haydon Bridge	NT 838 658 (Dec 1939 – May 1945)
B.4	Whitfield	NY 779 576 (Dec 1939 – May 1945)
C.1	Gilsland	NY 641 658 (Dec 1939 – May 1945)
C.2	Brampton	NY 532 604 (Dec 1939 – May 1945)
C.3	Armathwaite	NY 504 486 (Dec 1939 – May 1945)
D.1	Alston	NY 724 462 (Dec 1939 – May 1945)
D.2	Wearhead	NY 860 402 (Dec 1939 – Sept 1940)
D.3	Culgaith	NY 598 305 (Dec 1939 – Mar 1940)
D.3	Culgaith	NY 615 294 (Mar 1940 – May 1945)
E.1	Caldbeck	NY 316 413 (Dec 1939 – May 1945)
E.2	Greystoke	NY 443 309 (Dec 1939 – May 1945)
E.3	Keswick	NY 287 229 (Dec 1939 – May 1945)
E.4	Dalston	NY 367 477 (May 1942 – May 1945)
F.1	Allonby	NY 098 432 (Dec 1939 – May 1945)
F.2	Cockermouth	NY 115 320 (Dec 1939 – May 1945)
F.3	Workington	NY 009 295 (Dec 1939 – May 1945)
G.1	Kirkbride	NY 228 584 (Dec 1939 – May 1945)
G.2	Dalston	NY 367 477 (Dec 1939 – May 1942)
G.3	Wigton	NY 252 493 (Dec 1939 – May 1945)
G.4	Silloth	NY 108 532 (Dec 1939 – May 1945)
H.1	Dumfries*	NX 981 751 (Dec 1939 – May 1945)
H.2	Cummertrees*	NY 145 661 (Dec 1939 – May 1945)
H.3	Kirkbean*	NX 969 588 (Dec 1939 – May 1945)
J.1	Canonbie*	NY 402 779 (Dec 1939 – May 1945)
J.2	Rockcliffe	NY 396 597 (Dec 1939 – May 1945)
J.3	Kirtlebridge*	NY 224 736 (Dec 1939 – May 1945)
K.1	Beattock*	NT 103 010 (Dec 1939 – May 1945)
K.2	Lockerbie*	NY 143 820 (Dec 1939 – Oct 1941)
K.2	Lockerbie*	NY 144 816 (Oct 1941 – May 1945)
K.3	Parkgate*	NY 045 909 (Dec 1939 – May 1945)
L.1	Eskdalemuir*	NY 256 975 (Dec 1939 – May 1945)
L.2	Bentpath*	NY 295 909 (Dec 1939 – May 1945)
L.3	Boreland*	NY 176 919 (Dec 1939 – May 1945)

(TNA, AIR 2/19568, AIR 2/19595; Wood, 1992: 282-283, 288, 304-305, 315, 326-327, 329, 334).

The new position of Group Commandant was created in 1943 and that of Observer Group Officer deleted. The Group Commandant for No 32 Group from 1943 to 1944 was Observer Commander FRW Graham and from 1944 to 1945 Observer Commander CJ Rowlands MBE (Wood, 1992: 269).

Carlisle Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Castletown

Unit	Sub-Sector Operations Room and Gun Operations Room
Region	Highland
NGR	ND 2127 6737 (Ops Block, Air Ministry Drawing No 1063/40)
NMRS	ND26NW 36
In use	1940 – 22 September 1941

Castletown opened as a satellite airfield in Wick Sector in May 1940 (Smith, 1983: 63). A Sub-Sector Operations Block was built at Castletown to Air Ministry drawing number 1063/40, becoming operational in 1940 (HRA, Castletown Record Plan of Station, Drawing Number WA15/514/41).

A fatal shooting took place in the Operations Room at 9.20am on 22 July 1940. A rifle belonging to Lance Corporal T Burns of 'A' Company, 5th Battalion Queen's Own Cameron Highlanders was accidentally discharged by Aircraftman Second Class J Muir, fatally wounding Private Thomas Campbell of 'A' Company, 5th Battalion Queen's Own Cameron Highlanders (TNA, AIR 28/138).

On 22 July 1940 two 3-inch anti-aircraft guns moved from Wick to Castletown and were manned by two sections of 297 HAA Battery, 36 AA Brigade. The Battery was located south of Castletown airfield (TNA, WO 166/2128) and, since it was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room at Castletown (TNA, WO 166/2129) it is assumed this was located in the Sub-Sector Operations Block on the airfield.

The new Sub-Sector Operations Room at Reiss became operational at 11pm on 22 September 1941, taking over from the Ops Room at Castletown. As one of the Senior Duty Controllers, Pilot Officer JH Emerson took the last watch at Castletown (TNA, AIR 28/138).

Clyde

Unit	Gun Operations Room
Region	Glasgow City
NGR	NS 5912 6547 (27 West George Street)
NMRS	Not allocated
In use	26 August 1939 – late July 1940

Unit	Gun Operations Room
Region	Lanarkshire (South Lanarkshire)
NGR	NS 5965 6029 (Aikenhead House)
NMRS	NS56SE 480
In use	late July 1940 – 23 February 1945

On 26 August 1939 Clyde Gun Operations Room was being linked up to all anti-aircraft gun positions and had a trial run, which was reported at midnight as successful (TNA, WO 166/2279). The GOR, a Class 'B' GOR, was at 27 West George Street (TNA, WO 166/2127).

Instructions were issued by Headquarters, 3rd AA Division, on 21 June 1940 that alternative accommodation for GOR Clyde was to be prepared forthwith at the site originally selected for the permanent GOR in Ormonde Avenue in Cathcart. As soon as this was ready, the commander of 42 AA Brigade was to move his HQ and the GOR to this site, at which point the GOR in West George Street was to be given up. However, these premises were never occupied and instead the GOR moved to 404 Gun Operations Room at Aikenhead House in late July 1940 (TNA, WO 166/2128). Aikenhead House was built in 1806 for John Gordon, a tobacco merchant, on the site of a seventeenth-century house, and was probably designed by David Hamilton, with wings added in 1823 (Williamson, Riches and Higgs, 1990: 530).

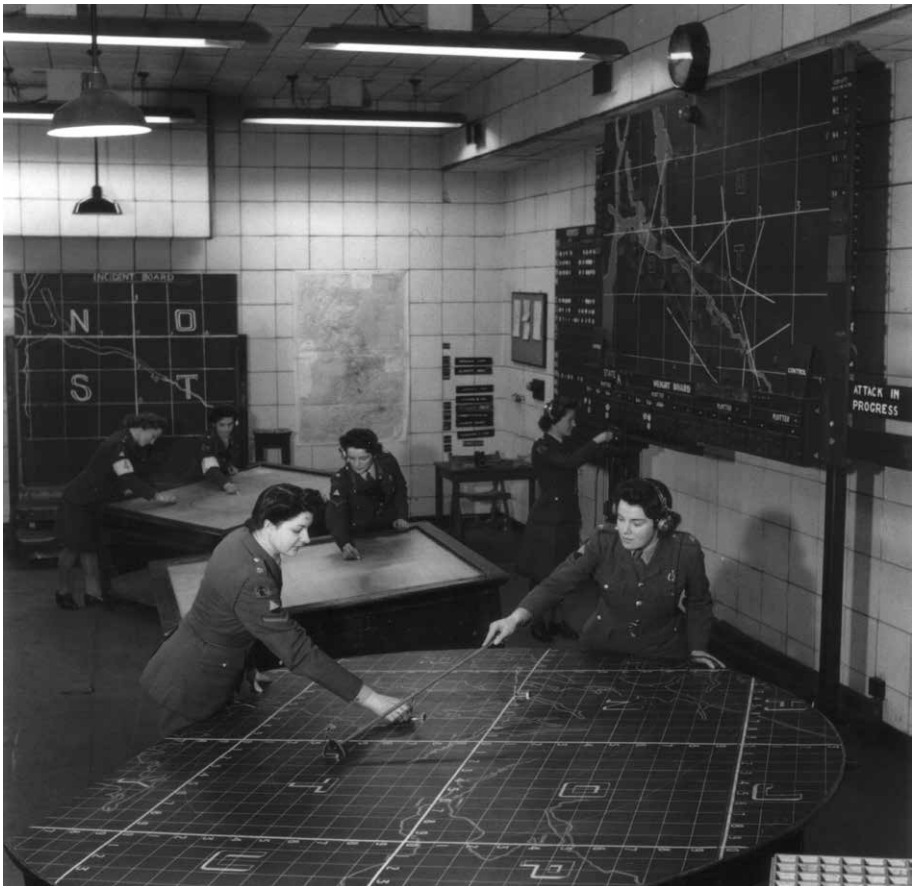
Aikenhead House was requisitioned at the start of the war for the British Army, although Glasgow Museums continued to use one room for storage of part of the Burrell Collection (GM, GMA.2013.1.2.5.238). The brick and concrete GOR was built to the rear of Aikenhead House (GM, GMA.2013.1.2.22.233).

At 8.55pm on 13 March 1941 Clyde GOR began the first of a long series of hostile plots, and the civilian air-raid sirens were sounded at 9.12pm. This signalled the start of the Clydeside Blitz that night. The HAA gun sites controlled by Clyde GOR were in operation without a break until approximately 6am on 14 March. At 4am the telephone line to AN2 gun site went faulty and was unusable, due to bomb damage, however the R/T network linking Clyde GOR to all the Clyde and Glasgow HAA gun sites remained in continuous operation and functioned well. The civilian all-clear was sounded at 6.25am (TNA, WO 166/2215).

In mid-1941 proposals were put forward to split the Clyde GDA into separate Sub-Areas controlled by Sub-Gun Operations Rooms, each subordinate to Clyde GOR at Aikenhead House (TNA, WO 166/2212). Telephone lines between Clyde GOR and Sub-GORs 'A' to 'F' were ordered on 3 November 1941, with two lines to 'A' Sub-GOR completed and working on 13 December. No other landlines to the Sub-GORs were working before the end of 1941 (TNA, WO 166/2215), with two lines to 'F' Sub-GOR completed on 15 January 1942, and two to 'C' Sub-GOR on 14 March (TNA, WO 166/7371). This indicates that the Sub-GORs did not become operational until early 1942.

The GOR at Aikenhead House controlled five Sub-Gun Operations Rooms: 9 ('A' Sub-GOR at Strathleven House, Dumbarton), 10 ('B' Sub-GOR at Melfort House, Bearsden), 11 ('C' Sub-GOR at Drumpark Farm, Coatbridge), 12 ('E'

53 Aerial view of Aikenhead House, showing the GOR building built to the rear (© Historic Environment Scotland).



54 404 Gun Operations Room, photographed on 13 March 1945 (© Imperial War Museum London H41499).

Sub-GOR at Merchiston House, Johnstone) and 13 ('F' Sub-GOR at Langhouse, Inverkip). See individual entries for further details. 'D' Sub-GOR was originally planned for Thorntonhall, but due to reducing numbers of guns in the Clyde GDA it was decided by 12 AA Division HQ on 27 May 1942 that this Sub-GOR would not open. Gun sites planned to be controlled by 'D' Sub-GOR were allocated to neighbouring Sub-GORs (TNA, WO 166/7369, WO 166/7371).

55 404 Gun Operations Room, photographed on 13 March 1945 (© Imperial War Museum London H41500).

The Anti-Aircraft Defence Commander was based in the Gun Operations Room and received all information on hostile raids, mainly from RAF Group and Sector Operations Rooms (TNA, AIR 10/4040). However, in order to improve the level of information on aircraft movements available, AA Command obtained several Ground Control of Interception (GCI) radars from the RAF. These radars were officially designated AA/GCI or AA No 5 Mk I (Sayer, 1950: 99). One of these mobile GCI radars was set up in January 1942 near East Kilbride, 6 miles from Clyde GOR. The radar was designated G503 and given the call sign 'Sugar 20' (TNA, AIR 26/103). The Wireless Set No 36 originally allocated to 'D' Sub-GOR was reallocated to East Kilbride AA/GCI when the Sub-GOR was cancelled and used in experiments on the transmission of GCI data (TNA, WO 166/7369). The AA/GCI radar was put on care and maintenance on 14 February 1945, with the site and buildings retained and the equipment stored such that the station could be put back into action within fourteen days. The Ops Room, Generator House, Aerial Tower and IFF Building were to be visited periodically. All connections to the AA No 5 Mk 1 radar transmitter and receiver were to be disconnected and the transmitter and receiver placed into storage (TNA, WO 166/16650).

In January 1945 404 AAOR at Aikenhead House was commanded by Captain W Blackwell, but was not listed in 8 AA Group Location Statement

No 6 dated 28 March 1945 (TNA, WO 166/16650), Clyde GDA having closed down on 23 February 1945 (TNA, AIR 25/234).

Coatbridge

Unit	Sub-Gun Operations Room
Region	North Lanarkshire
NGR	NS 7050 6453 (Drumpark Farm)
NMRS	Not allocated
In use	spring 1942 – 1 March 1943

Coatbridge was 'C' Sub-GOR of the Clyde GOR at Aikenhead House, and was located at Drumpark Farm (TNA, WO 166/7399). The farm was part of Drumpellier & Mount Vernon Estates and was listed in 1940 as rented out to Hugh and Anderson Blackwood (Valuation Roll, Drumpark Farm, 1940-41).

Two landlines between Clyde GOR and 'C' Sub-GOR were completed on 14 March 1942 (TNA, WO 166/7371). 'C' Sub-GOR closed down on 1 March 1943 (TNA, WO 166/11216).

Dumbarton

Unit	Sub-Gun Operations Room
Region	West Dunbartonshire
NGR	NS 3963 7811 (Strathleven House)
NMRS	NS37NE 36
In use	early 1942 – 1 June 1942

Telephone lines between Clyde GOR and Sub-GORs 'A' to 'F' were ordered on 3 November 1941. The first two lines were to 'A' Sub-GOR and these were completed and working on 13 December 1941, with the Sub-GOR probably becoming operational in early 1942 (TNA, WO 166/2215),

Dumbarton was 'A' Sub-GOR of the Clyde GOR at Aikenhead House, and was located at Strathleven House (TNA, WO 166/7399). This property is considered one of Scotland's earliest and most important classical country houses, built in the Palladian style for William Cochrane of Levenside and Kilmaronock around 1690, probably to a design by James Smith (Gifford and Walker, 2002: 762-763).

The house was owned in 1942 by Humphry Crum Ewing who inherited the house as well as the business of James Ewing & Company (Valuation Roll, Strathleven Mansion-house, 1940-41), which had owned several sugar plantations in Jamaica, St Kitts, Antigua and Barbados. The company had been involved in the slave trade until it was abolished in 1834 (*The Inverness Journal and Northern Advertiser*, 1 August 1823; *The Greenock Telegraph and Clyde Shipping Gazette*, 9 May 1901). Most of Humphry Crum Ewing's time was spent in Jamaica (*The Chronicle and Courier*, 28 March 1947) so the house was readily available for use by the British Army.

The withdrawal of 100 HAA Regiment from Clyde GDA necessitated the move of 155 HAA Regiment to 'F' Sub-GOR at Inverkip and the closure of 'A' Sub-GOR on 1 June 1942. Gun site AN2 was re-allocated to 'F' Sub-GOR at Inverkip and N6 to 'B' Sub-GOR at Bearsden (TNA, WO 166/7369, WO 166/7371).

Dundee

Unit	Gun Operations Room
Region	Dundee City
NGR	NO 3726 3233 (Dryburgh Farm)
NMRS	Not allocated
In use	1942 – 7 April 1944

341 Gun Operations Room, a Class 'B' GOR, was operating in Dundee, in May 1942 (TNA, WO 212/81). The Commanding Officer by October 1942 was Captain Charles d'Orville Pilkington Jackson (TNA, WO 166/7309), a prominent British sculptor known at that time for numerous war memorials (Anon, 1942: 1605). He was replaced by Captain WC Heggie in November 1943, Captain Jackson having been posted to command 403 GOR at Craigiehall (TNA, WO 166/11210). By 21 January 1944 the Commanding Officer at Dundee was Lieutenant RA Avison (TNA, WO 166/14650).

341 Anti-Aircraft Operations Room Dundee closed on 7 April 1944 (TNA, WO 166/14638).

Dundee

Unit	Observer Centre
Region	Dundee City
NGR	NO 4001 3046 (St Cuthbert's Church Hall, Constitution Road, Dundee)
NMRS	NO43SW 267
In use	18 October 1939 – 12 May 1945

Unit	Emergency Centre
Region	Dundee City
NGR	NO 4046 3070 (East Hall, St Andrews Church, King Street, Dundee)
NMRS	NO43SW 105

Difficulties were experienced in covering the complete area of No 37 Observer Group due to the lack of telephone exchanges. The Commandant of the Observer Corps noted on 26 May 1939 that it would be necessary for the Air Ministry to rent telephone lines from Clova to Kirriemuir (12½ miles), Aberlemno to Forfar (5 miles) and Tarfside to Edzell (9½ miles) (TNA, AIR 16/48).

Despite the logistical challenges, No 37 Group was formed in June 1939 (TNA, AIR 25/232; Wood, 1992: 329). The recruiting of 140 men by

56 Dundee Observer Centre in St Cuthbert's Hall, in December 1939 (© DC Thomson & Co Ltd).

the Special Constabulary for Dundee Centre began in August 1939 with Reginald R Ovenstone promoted from Sergeant to Inspector in the Dundee Special Constabulary to take charge of the Group (*The Courier and Advertiser*, Dundee, 10 August 1939). Following this, No 37 Group was manned and in operation from 1pm on 18 October 1939 (TNA, AIR 16/49). The Controller of No 37 Group was RR Ovenstone and the Observer Group Officer was Norman JH Goodchild (TNA, AIR 2/20016; Wood, 1992: 270).

Selection of sites for Observer Posts began in June 1939 (TNA, AIR 2/20072, AIR 2/20073, AIR 2/20076, AIR 2/20077, AIR 2/20078, AIR 2/20079, AIR 2/20081, AIR 2/20083) with, for example, St Cyrus visited on 12 June and approval for the use of the site received on 27 June. The Post Hut and surrounding fence had been erected by 18 September (TNA, AIR 2/20081), and hence the Post was ready for operations from 18 October 1939 (TNA, AIR 16/49).

The Observer Posts within No 37 Group were as follows:

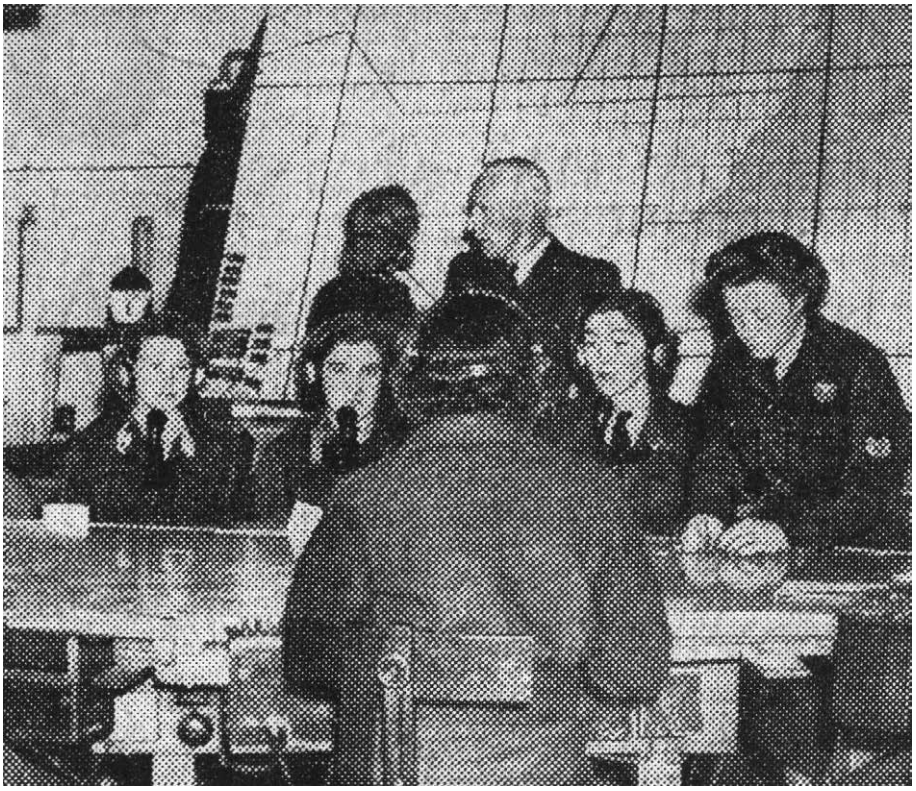
A.1	Auchenblae	NO 728 785 (Oct 1939 – May 1945)
A.2	Inverbervie	NO 824 727 (Oct 1939 – May 1945)
A.3	Laurencekirk	NO 716 720 (Oct 1939 – May 1945)
B.1	St Cyrus	NO 752 647 (Oct 1939 – May 1945)
B.2	Inverkeilor	NO 688 509 (Oct 1939 – May 1945)
B.3	Brechin	NO 587 610 (Oct 1939 – May 1945)

C.1	Friockheim	NO 594 503 (Oct 1939 – May 1945)
C.2	Arbroath	NO 6353 4077 (Oct 1939 – May 1945)
C.3	Carnoustie	NO 567 360 (Oct 1939 – May 1945)
D.1	Letham	NO 526 499 (Oct 1939 – May 1945)
D.2	Newbigging	NO 514 376 (Oct 1939 – May 1945)
D.3	Newtyle	NO 319 392 (Oct 1939 – Sep 1941)
D.3	Newtyle	NO 315 396 (Sep 1941 – May 1945)
D.4	Glamis	NO 385 454 (Oct 1939 – May 1945)
E.1	Dunkeld	NO 035 433 (Oct 1939 – May 1945)
E.2	Alyth	NO 235 476 (Oct 1939 – May 1945)
E.3	Meikleour	NO 1651 3915 (Jul 1941 - May 1945)
F.1	Clova	NO 341 714 (Oct 1939 – May 1945)
F.2	Lintrathen	NO 2912 5490 (Oct 1939 – May 1945)
F.3	Glenisla	NO 219 606 (Oct 1939 – May 1945)
G.1	Cortachy	NO 383 601 (Oct 1939 – May 1945)
G.2	Aberlemno	NO 512 554 (Oct 1939 – May 1945)
G.3	Forfar	NO 458 492 (Oct 1939 – May 1945)
H.1	Tarfside	NO 491 801 (Oct 1939 – May 1945)
H.2	Edzell	NO 594 690 (Oct 1939 – May 1945)
H.3	Fern	NO 484 621 (Oct 1939 – May 1945)
J.1	Blair Atholl (Watcher Post)	NN 869 666 (Jul 1940 – May 1945)
J.2	Aberfeldy (Watcher Post)	NN 857 485 (Aug 1940 – May 1945)
J.3	Bridge of Gaur (Watcher Post)	NN 507 574 (28 Dec 1940 – May 1945)

(TNA, AIR 2/20069, AIR 2/20070, AIR 2/20071, AIR 2/20072, AIR 2/20073, AIR 2/20075, AIR 2/20076, AIR 2/20077, AIR 2/20078, AIR 2/20079, AIR 20080, AIR 20081, AIR 2/20083, AIR 2/20085, AIR 2/20086, AIR 2/20122; Wood, 1992: 322-323, 329, 332).

The new position of Group Commandant was created in 1943 and that of Observer Group Officer deleted. From 1943 to 1947 the Group Commandant of No 37 Group was Observer Commander NJH Goodchild, the former OGO of the Group (Wood, 1992: 270).

No 37 Group, along with Nos 36 (Dunfermline), 38 (Aberdeen) and 39 (Inverness) Groups, was involved in a particularly efficient performance on the night of 9/10 June 1943. Four Vickers Wellingtons and two Armstrong Whitworth Whitleys from Lossiemouth and Kinloss airfields were on a night cross-country exercise when their airfields became fog-bound. Three of the Wellingtons were ordered to make for Banff and landed at 1.11am, 3.18am and 4.07am before that airfield was fog-bound. A Whitley was sent to Wick and landed there at 4.18am.



57 Dundee Observer Centre in St Cuthbert's Hall, in 1951 (© DC Thomson & Co Ltd).

The other Whitley was sent to Leuchars, landing safely there at 4.27am. The last Wellington was sent from Lossiemouth to Peterhead, which it was unable to find due to the weather, and then re-directed to Dyce. It was unable to land at Dyce as it was by then fog-bound and thus the Wellington was then sent to Leuchars, where it safely landed at 5.20am. With one exception, all six aircraft were tracked exclusively by the Royal Observer Corps, a remarkable feat considering the weather conditions (Winslow, 1948: 188-189).

Dundee Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Dunfermline

Unit	Sub-Gun Operations Room
Region	Fife
NGR	NT 0922 8677 (Drill Hall, Elgin Street, Dunfermline)
NMRS	NT08NE 484
In use	circa March 1942 – 19 November 1942

On 2 March 1942 approval was received for the formation of two Sub-GORs in Forth Gun Defended Area. Locations for the two Sub-GORs were approved one

week later, with one located at Dunfermline (TNA, WO 166/7393), designated as Sub-Gun Operations Room 7 (TNA, WO 212/81). It is likely this was located in the Drill Hall on Elgin Street in Dunfermline (TNA, WO 166/7393). On 19 November 1942 the Forth Sub-GORs were ordered to close down forthwith and all anti-aircraft gun sites were to be controlled by the main GOR at Craigiehall (TNA, WO 166/7309).

Dunfermline

Unit	Observer Centre
Region	Fife
NGR	NT 0910 8741 (Ministry of Labour Building, 11 Guildhall Street, Dunfermline)
NMRS	NT08NE 412
In use	9 May 1939 – 1943

Unit	Observer Centre
Region	Fife
NGR	NT 0920 8792 (Victoria Works, Pilmuir Street, Dunfermline)
NMRS	NT08NE 465
In use	1943 – 12 May 1945

Unit	Emergency Centre
Region	Fife
NGR	NT 0922 8728 (Squash Racquet Court, Abbey Park House, Dunfermline)
NMRS	NT08NE 366

During 1936 the Air Ministry drew up plans to extend the Observer Corps system to cover the whole of Great Britain, but more immediately to cover the area between the Rivers Tees and Tay with the formation of two new Observer Groups, one extending from the Tees to the Tweed and one from the Tweed to Dundee. The latter was to be numbered No 31 Observer Group with the Observer Centre in Edinburgh (TNA, AIR 2/1772).

In December 1936 it was proposed by Fighter Command to establish the Observer Centre for No 31 Group in Dunfermline, rather than Edinburgh, and this was occupied from early 1938. However on 2 March 1938, Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command, expressed concerns about that Group covering both sides of the Firth of Forth, and the communications difficulties this would cause. Air Chief Marshal Dowding noted:

> *No 36 Group to be formed in 1939 instead of 1940. The area to be enlarged to include 12 Posts North of the Firth of Forth now in No 31 Group. The existing No 31 Group Centre at Dunfermline to be made the Centre for No 36 Group and to operate as such from the 31st of March 1939* (TNA, AIR 2/1772).

His recommendations that No 31 Group area be amended to stop at the Forth, and a new Centre for the Group be established in Galashiels, were approved, with the former No 31 Group Centre in Dunfermline becoming the Observer Centre for No 36 Group. No 36 Observer Group was formed in 1938 (Wood, 1992: 270) and became operational on 9 May 1939 (TNA, AIR 2/1772). The Observer Group Officer was Squadron Commander GF Breese DSC, with the Group Headquarters at his home address in St Andrews (TNA, AIR 2/19719; AIR 2/20014; *Three Six*, Vol 1 No 8, May 1941: 2). The Centre Controller was Lieutenant-Colonel Angus Robertson MC, a director of linen manufacturers, Hay & Robertson Ltd (*Three Six*, Vol 1, No 7, April 1941: 2; The *Courier and Advertiser*, 1 January 1941; *The Citizen*, 6 October 1945).

With Fife falling within the area originally planned for No 31 Observer Group, the siting work that began in February 1937 for Posts was carried out under 31 Group, but with the formation of No 36 Group in 1938, this work was taken over by the latter Group. However, even as the Group was about to become operational, there were still last-minute details to attend to, as per the letter from William H Cousins, the Head Special at B.3 Post, Elie, dated 25 April 1939, asking where the Post equipment was to be stored, if not to be left in the Hut. The response from the Scottish Area Commandant was that the Post Instrument and Post Chart must not be left in the Hut except when in use (TNA, AIR 2/20014).

The Observer Posts established within No 36 Group were as follows:

A.1	Tayport	NO 467 279 (May 1939 – Apr 1942)
A.1	Tayport	NO 454 288 (Apr 1942 – May 1945)
A.2	Cupar	NO 385 149 (May 1939 – May 1945)
A.3	Newburgh	NO 238 186 (May 1939 – May 1945)
A.4	Peat Inn	NO 460 098 (Mar 1940 – Apr 1940)
A.4	St Andrews	NO 528 154 (3 Dec 1941 – May 1945)
B.1	St Andrews	NO 523 156 (May 1939 – 20 Oct 1939)
B.1	St Andrews	NO 528 154 (20 Oct 1939 – 3 Dec 1941)
B.1	May Island	NT 656 994 (Dec 1941 – May 1945)
B.2	Crail	NO 60640774 (May 1939 – May 1945)
B.3	Elie	NO 484 003 (May 1939 – May 1945)
C.1	Leven	NO 389 017 (May 1939 – May 1945)
C.2	Thornton	NT 271 968 (May 1939 – May 1945)
C.3	Falkland	NO 259 076 (May 1939 – May 1945)
C.4	Peat Inn	NO 460 098 (Apr 1940 – May 1945)
D.1	Kinghorn	NT 265 867 (May 1939 – May 1945)
D.2	Inverkeithing	NT 125 833 (May 1939 – Nov 1939)
D.2	Inverkeithing	NT 126 831 (Nov 1939 – May 1945)
D.3	Leslie	NO 247 043 (May 1939 – May 1945)

E.1	Milnathort	NO 118 052 (May 1939 – May 1945)
E.2	New Mills	NT 016 881 (May 1939 – May 1945)
E.3	Muckhart	NO 007 015 (May 1939 – May 1945)
E.4	Kelty	NT 129 937 (Dec 1939 – May 1945)
F.1	Tillicoultry	NS 942 942 (May 1939 – Jun 1941)
F.1	Tillicoultry	NS 938 951 (Jun 1941 – May 1945)
F.2	Falkirk	NS 877 786 (May 1939 – May 1945)
F.3	Bannockburn	NS 820 900 (May 1939 – May 1945)
G.1	Callander	NN 636 085 (May 1939 – May 1945)
G.2	Braco	NN 835 095 (May 1939 – Apr 1942)
G.2	Braco	NN 827 088 (Apr 1942 – May 1945)
G.3	Doune	NN 724 024 (May 1939 – May 1945)
H.1	Crieff	NN 875 222 (May 1939 – May 1945)
H.2	Dunning	NO 019 141 (May 1939 – May 1945)
H.3	Blackford	NN 898 095 (May 1939 – May 1945)
H.4	Killin	NN 573 329 (Jul 1940 – May 1945)
J.1	Scone	NO 143 270 (May 1939 – May 1945)
J.2	Bridge of Earn	NO 127 185 (May 1939 – May 1945)
J.3	Methven	NO 018 259 (May 1939 – Jun 1939)
J.3	Methven	NO 025 263 (Jun 1939 – May 1945)
K.1	Meikleour	NO 1651 3915 (May 1939 – Jul 1941)
K.1	Bankfoot	NO 080 348 (Jul 1941 – May 1945)
K.2	Downfield	NO 395 336 (May 1939 – May 1945)
K.3	Abernyte	NO 255 326 (May 1939 – May 1945)
K.4	Gauldry	NO 364 239 (Dec 1941 – May 1945)

(TNA, AIR 2/20013, AIR 2/20014, AIR 2/20016, AIR 2/20082, AIR 2/20084, AIR 2/20087, AIR 2/20090, AIR 2/20091, AIR 2/20092, AIR 2/20322, AIR 2/20323, AIR 2/20466, AIR 2/20467; Wood, 1992: 322-323, 326-330, 332, 334, xxx).

No 36 Observer Group, along with No 31 Group, plotted the first enemy air attack over the UK during the Second World War, with around a dozen Junkers Ju 88s attacking ships in the Firth of Forth on 16 October 1939 (Wood, 1992: 65).

In October 1939 *The Fife Free Press* described the Dunfermline Centre:

> *At the reporting centre, which links up the work of twenty or more observation posts, men sit round the table, each with his telephone. They are receiving reports about the movements of aircraft from the many posts in the Group. One of the*

'plotters', as they are called, is a learned judge, one is a reporter who works in his court, one is a navvy. Others are local business and professional men, insurance clerks, solicitors, accountants.

It looks for all the world as if they had discovered some new gambling game, with chips and counters and a croupier's rake. They are moving coloured signs on a table map to show the latest information about aircraft. Every now and then the croupier's rake removes the signs that have already become out of date. On a dias above them sit 'tellers' 'phoning on the position, number and height of the aircraft observed.

The room is full of a low murmur of voices, not the sharp voices of a telephone exchange, but the quiet voices of men on the watch, playing a game with sky as their board and aircraft as their counters. They … are plotting the position of all aircraft in their sector, because they want to be sure of themselves when they track the course of enemy visitors. That is what they are waiting and working for – the moment when their observation posts will report enemy aircraft approaching, and they can begin in earnest their task of tracking down raiders.

Meanwhile, no-one can go on plotting aircraft all day and all night. At the end of the watch, another crew takes over in the room above the cattle-market. The judge, the navvy, the reporter, the accountant and the rest of them put on their coats in the ante-room where the dart board hangs. "See you tonight," says the learned judge to the navvy as they walk downstairs. They are meeting that evening to celebrate the anniversary of their formation as an observer crew. There will be a supper and songs and stories – and no speeches. It's a sociable war! (*The Fife Free Press*, 21 October 1939).

The new position of Group Commandant was created in 1943 and that of Observer Group Officer deleted. In No 36 Group the Group Commandant from 1943 to 1945 was Observer Commander Robert Cecil Blackwood, MC (Wood, 1992: 270), who had been OGO at No 31 Group until that point (Wood, 1992: 271).

No 36 Group, along with Nos 37 (Dundee), 38 (Aberdeen) and 39 (Inverness) Groups, was involved in a particularly efficient performance on the night of 9/10 June 1943. Four Vickers Wellingtons and two Armstrong Whitworth Whitleys from Lossiemouth and Kinloss airfields were on a night cross-country exercise when their airfields became fog-bound. Three of the Wellingtons were ordered to make for Banff and landed at 1.11am, 3.18am and 4.07am before that airfield was fog-bound. A Whitley was sent to Wick and landed there at 4.18am. The other Whitley was sent to Leuchars, landing safely there at 4.27am. The last Wellington was sent from Lossiemouth to Peterhead, which it was unable to find due to the weather, and then re-directed to Dyce. It was unable to land at Dyce as it was by then fog-bound and thus the Wellington was then sent to Leuchars, where it safely landed at 5.20am. With one exception, all six aircraft were tracked

exclusively by the Royal Observer Corps, a remarkable feat considering the weather conditions (Winslow, 1948: 188-189).

Dunfermline Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Dyce

Unit	FSHQ
Region	Aberdeen City
NGR	NJ 8728 1256 (Ops Block, Air Ministry Drawing No 12289/39)
NMRS	Not allocated
In use	23 May 1940 – 24 May 1942

On 14 April 1940 'B' Flight, No 602 Squadron, Royal Auxiliary Air Force, was sent to Dyce under Flight Lieutenant AFC 'Sandy' Johnstone as the Flight Commander. He recalled:

> *We set up our headquarters in the old Aberdeen Flying Club premises situated on the opposite side of the airfield from the main RAF building*[s]*, which were occupied by units of Coastal Command.*
>
> *Later, it was decided to add a proper Fighter Command Operations Room and we were inundated with joiners, carpenters, painters and a veritable army of Post Office engineers. Owing to a shortage of telephone switchboards we had to make do with individual telephones and at one time were the proud possessors of no fewer than 23 such instruments, all alike and placed along the newly constructed dias. This was fine and looked very imposing until one of them rang. Then it was sheer pandemonium trying to find out which one it was. If two rang together we just gave up, for by the time half of the hand-pieces had been replaced on the wrong bases due to the haste adopted, the caller had given up and rung off.*
>
> *There was one telephone we could not fathom all the same. This was the twenty-third in the line and it was set a little apart from the others. Many times, in an effort to discover to where the instrument was connected, we turned the small handle but got no reply. After it had been lying in its aloof and rather lonely position for more than three weeks, the mystery of its connections having not yet been unravelled, it suddenly burst forth, ringing shrilly.*
>
> *Archie McKellar happened to be nearby and picked up the receiver while we all crowded round, eager to hear the voice of the mystery caller. "This is the AOC," said a voice in the distance, but loud enough for most of us to hear as we looked over Archie's shoulder. "Oh yes?" replied our companion. "Well this is the King of Siam here. How do you do?" For a second or two there was silence and I could hear someone taking a deep breath. Then came the angry shout: "Dammit, you young whippersnapper. Who are you anyway? Do you realise who you are talking to?" Archie was still not certain but guessed that the excited, spluttering voice*

coming from the earpiece must have quite a bit of rank judging by the noise it was making. "I'm sorry – I couldn't quite catch that," said Archie quietly. This time the silence was even longer. When the voice came through once more it was, by now, calm and collected and speaking very deliberately so that no-one could possibly make any mistakes. "This is Air Vice-Marshal RE Saul – can you understand that? Now do you know to whom you are speaking?" Quick as a flash, Archie muttered in the affirmative and added: "Do you know to whom you *are speaking?" "No." "Thank goodness for that," replied Archie, as he hastily replaced the receiver. There was a rueful smile on his face. "That must be a direct line to the AOC. Imagine that – what a hell of a way to find out."*

A somewhat similar incident occurred over a teleprinter which was set up in our crew room, there being no room for it in the Operations Room. A charming little WAAF invaded the sanctuary of this room early one morning while those of us not at readiness were still lolling around in our pyjamas. She strode over to the machine and, with only a curt nod in our general direction, sat down on a chair placed in front of it. All day long she sat there, except for a break for lunch. Next morning she was back again and took up her position as before. Although we made various attempts at conversation, she was either extremely shy or didn't want to have anything to do with us. Certainly, she didn't give us a great deal of encouragement. Late that afternoon, after her second day of silent vigil, one of the Post Office engineers happened to see her sitting there, patiently waiting. He walked over. "What are you doing there?" he asked. "Waiting for any messages to come through from Group," she replied demurely. The man threw back his head and laughed. He clutched his sides and his antics made us look up. When he had recovered he turned to the girl who was ignoring him after his outburst of mirth. His voice trembled as he told her: "Well, I'm afraid you'll have a long wait, miss. You see, it's not connected up at the other end yet." There was silence in the room. The girl stared at him, her mouth hanging open in amazement. For a moment, it looked as if she would burst into tears. Grimly, she got to her feet, picked up her bag and with shoulders straight marched out of the room amid gales of laughter.

Like the twenty-third telephone, this teleprinting device remained mute and mysterious for many more days. While we were having afternoon tea about a week later, it suddenly burst into life and clattered away like a demented typist. Everyone made a dive for it and gathered round to see what was being said. But the hieroglyphics on the roll of paper were quite unintelligible to us. Waiting until it came to rest, one of my companions, who claimed to have some knowledge of how such a machine operated, tapped back: "Are you a blonde or brunette?" For almost 10 seconds the machine remained quiet. The operators had no doubt decided to ignore this leading question. All at once it started to clatter again. "I am an airman," spat back the machine, with more venom than we imagined possible from such an impersonal lump of steel (Johnstone, 1969: 75-77).

58 Supermarine Spitfire Mk V of No 603 Squadron in wintry conditions at Dyce on 4 February 1942 (© Imperial War Museum London CH4838).

On 12 May 1940 Squadron Leader RA Chignell was posted to Dyce as Fighter Sector Commander and Senior Controller. Dyce FSHQ became operational on 23 May 1940 (TNA, AIR 28/235), although the Operations Record Book of No 13 Group gives 12.01am on 5 June 1940 as the date and time the sector became operational (TNA, AIR 25/232). On 2 July 1940 the Operations Block was partly revetted with sods to reduce the chances of damage from bomb splinters (TNA, AIR 28/235).

No 603 Squadron under Dyce Sector control had considerable success during July 1940. On 3 July a Heinkel He 111 was shot down off Peterhead, a Junkers Ju 88 was shot down approximately 5 miles south-east of Aberdeen, and another Ju 88 was shot down into the sea off Stonehaven. Further success came three days later with the destruction of a Junkers Ju 88 approximately 20 miles east of Aberdeen. A Heinkel He 111 was shot down over Aberdeen on 12 July, crashing into the unfinished ice rink on South Anderson Drive. Further kills were achieved by 603 Squadron, a Heinkel He 111 on 15 July and another the following day, 25 miles off Fraserburgh (TNA, AIR 28/235).

On 19 July 1940, Air Vice-Marshal RE Saul, Air Officer Commanding No 13 (Fighter) Group, flew to Dyce and inspected the FSHQ. Air Vice-Marshal M Henderson, AOC No 14 (Fighter) Group visited Dyce on 15 August 1940. Sir Archibald Sinclair, Secretary of State for Air, visited on 3 September and made a very thorough inspection of the station accompanied by the Station Commander, Group Captain F Crerar. Sinclair emphasised the necessity for dispersal of all new buildings, from experience gained from recent German bombing attacks in the south of England (TNA, AIR 28/235).

On 13 October 1940 Dyce FSHQ was transferred from No 13 (Fighter) Group to No 14 (Fighter) Group (TNA, AIR 25/232). His Royal Highness Prince Bernhard of the Netherlands visited the Sector Operations Room on 25 January 1941 and expressed a great deal of interest in what he saw and heard. At 6pm on 27 February Air Chief Marshal Sir William Sholto Douglas, Commander-in-Chief of Fighter Command, inspected the Operations Block. The weather was bad and there was a great deal of mud on the FSHQ side of the airfield. Air Chief Marshal Douglas was surprised at the difficulties under which operations took place (TNA, AIR 28/235). Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 204 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries.

On 19 March 1941 VHF R/T was introduced in Dyce Sector and it was quickly realised how much easier the control of aircraft was following from 10 months using HF radio. The satellite airfield at Montrose changed over to VHF at 4.30pm on 24 March. No 232 Squadron at the satellite airfield at Elgin switched over to VHF on 1 April 1941 (TNA, AIR 28/235).

In the early hours of 6 April 1941, the largest concentration of enemy aircraft seen up to that date in the Sector passed over in the direction of the Clyde. Efforts were made to intercept but the moon was obscured by cloud and no success was achieved (TNA, AIR 28/235).

Following the completion of the Operations Room at Peterhead in May 1942, FSHQ Dyce moved to the new Sector Operations Room at Peterhead on 23 May 1942, and FSHQ Peterhead took over from Dyce at 12.01am on 24 May 1942 (TNA, AIR 28/637).

Forth

Unit	Gun Operations Room
Region	City of Edinburgh
NGR	NT 2479 7412 (8 Wemyss Place)
NMRS	NT27SW 1186
In use	24 August 1939 – 31 October 1941

Unit	Gun Operations Room
Region	City of Edinburgh
NGR	NT 1670 7536 (Craigiehall)
NMRS	NT17NE 29.11
In use	31 October 1941 – 21 April 1945

With rising tensions in Europe, from 11.55am on 24 August a signal was sent by Anti-Aircraft Command instructing that Forth GOR in 8 Wemyss Place was to be immediately manned on a skeleton basis (TNA, WO 166/2127). Prior to this, it

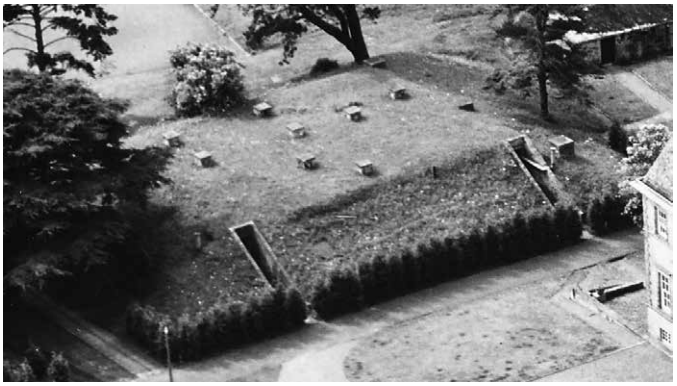
had been manned for training exercises, the earliest known being on 1 April 1939 (TNA, AIR 25/219).

The wartime propaganda account of Anti-Aircraft Command by the Ministry of Information records the events of 16 October 1939, when a force of Junkers Ju 88 bombers from *Kampfgeschwader* 30 attacked Royal Navy vessels in the Firth of Forth:

> *At 9.20 in the morning of October 16th, 1939, the Gun Operations Room in the Forth Area started to record the approach of enemy aircraft. All the morning these plots continued, the aircraft flying very high and obviously out on reconnaissance. When they were seen by gun crews, which was rarely, they were too high to be positively identified, and as they were only isolated planes, no fire was opened. At twenty-seven minutes past two that afternoon, operators in he Forth Gun Operations Room were astonished to see a red light flash up, meaning 'Guns in Action'. No warning of any sort had been received, and no sirens had sounded. They immediately sent out the order 'Action' to all sites, and almost at that moment enemy aircraft appeared over the Forth Bridge. No attempt was made to bomb the bridge itself; the Germans were trying for two warships lying near it, and for another coming up the Forth.*
>
> *A gun site south of the Forth* [Battery RSG 1 at Dalmeny (Jeffrey, 1992: 18)] *was busily engaged in gun drill when suddenly the spotters saw what was unmistakably a German aircraft approaching the Forth Bridge. Hurriedly the crew changed their dummy ammunition for live, while their instruments were laid on the plane. Before they could open fire it had dived too low, but another had appeared from the clouds. This time the gunners were more fortunate and shot a large portion of the Nazi's tailplane down into the Firth of Forth. This raider was finished off by a Spitfire, and crashed into the sea off Port Seton. This Heavy AA Battery was the first Anti-Aircraft Battery to help in bringing down an enemy raider over this country* (Ministry of Information, 1943: 17-18).

Information was received by 36 AA Brigade on 19 June 1940 that a request had been made to higher authority to make available Craigiehall as the Brigade HQ and Forth GOR. This was due to concerns that Wemyss Place was in a vulnerable part of Edinburgh and, if damaged by air attack, all the anti-aircraft guns in Edinburgh and on both sides of the Forth would be completely disconnected from control as well as information on aircraft movements. On 3 July information was received by 36 AA Brigade about the modifications to be carried out at Craigiehall in order to accommodate Forth GOR (TNA, WO 166/2266).

Forth GOR, a Class 'B' GOR, moved from 8 Wemyss Place to Craigiehall on 31 October 1941 (TNA, WO 166/2268). Craigiehall House was built by Sir William Bruce in 1698-99. The House and Estate were purchased by Archibald Philip, 5th Earl of Rosebery in 1915 but was unoccupied until Mr Morton took out a 21-year lease in 1926. The house was refurbished by Sir Robert Lorimer and then lived in by the Mortons, but they terminated their lease in 1933. Craigiehall then opened in January 1933 as The Riverside Hotel and Country Club with



59 Aerial view of Forth GOR at Craigiehall (© Historic Environment Scotland).

60 403 Gun Operations Room, photographed on 13 March 1945 (© Imperial War Museum London H41497).

61 403 Gun Operations Room, photographed on 13 March 1945 (© Imperial War Museum London H41498).

Mr Ernest Thomson as landlord. Thomson continued to run the hotel until the lease was terminated abruptly upon the requisitioning of the property by the War Office on 2 September 1939 (Innes, 1996: 19, 60-63).

On 2 March 1942 approval was received for the formation of two Sub-GORs in Forth Gun Defended Area. Locations for the two Sub-GORs were approved one week later at Dunfermline and Ingliston House (TNA, WO 166/7393). See individual entries for further details.

The Anti-Aircraft Defence Commander was based in the Gun Operations Room and received all information on hostile raids, mainly from RAF Group and Sector Operations Rooms (TNA, AIR 10/4040). However, in order to improve the level of information on aircraft movements available, AA Command obtained several Ground Control of Interception (GCI) radars from the RAF. These radars were officially designated AA/GCI or AA No 5 Mk I (Sayer, 1950: 99). One of these mobile GCI radars, designated G510, was set up in October 1942 near 403 GOR (TNA, AIR 26/103).

62 Forth Gun Operations Room Officers and NCOs, April 1945, Captain Cd'O Pikington Jackson seated second from left (© Scotsman P1913).

On 16 August 1943 an exercise was held with the new emergency GOR and wireless room. The trial was considered satisfactory, but further details regarding telephones were to be settled. Two days later, three US Army officers visited GOR Forth (TNA, WO 11210).

In November 1943 Captain Charles d'Orville Pilkington Jackson, a prominent British sculptor who had produced many memorials to the First World War, was posted from 341 GOR at Dundee to command 403 GOR at Craigiehall (TNA, WO 166/11210; Anon, 1942: 1605). Captain Pilkington Jackson remained in command until the GOR closed down (NLS, Acc.7445 Box 48).

The Forth Gun Defended Area became non-operational on 16 February 1945 and the guns were transferred elsewhere (TNA, AIR 25/234). However, it was not until 21 April 1945 that 403 GOR and the associated GCI radar G510, became non-operational and began disbandment (TNA, WO 166/16650).

Fort William

Unit	Sub-Gun Operations Room
Region	Highland
NGR	NN 1066 7417 (former Drill Hall)
NMRS	NN17SW 95
In use	circa 1942 – circa 1945

The Sub-Gun Operations Room opened in Fort William circa 1942. Fort William Gun Defended Area was transferred from 51st AA Brigade control to 42nd AA Brigade on 9 October 1943 (TNA, WO 166/11225).

Galashiels

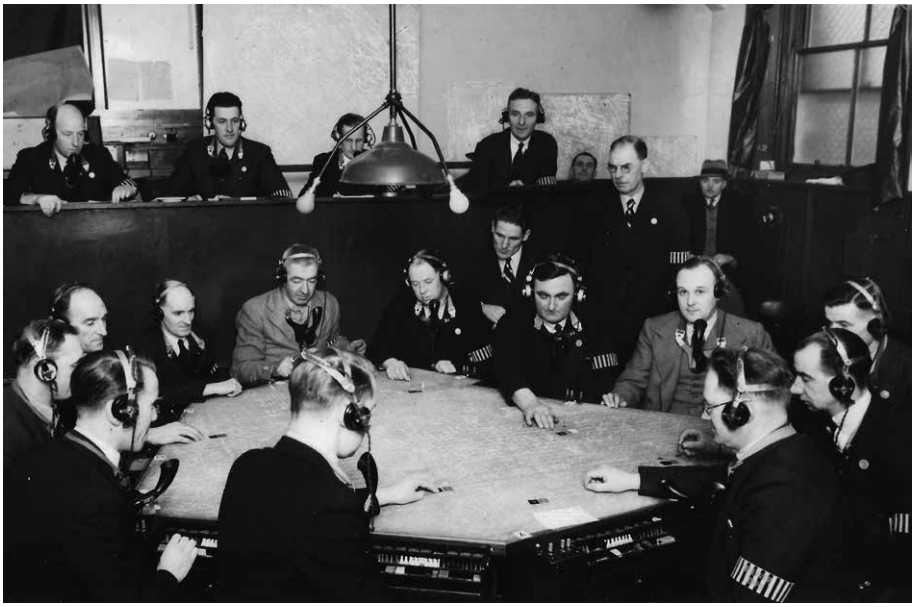
Unit	Observer Centre
Region	Scottish Borders
NGR	NT 4929 3608 (Corn Exchange, 86 Overhaugh Street, Galashiels)
NMRS	Not allocated
In use	9 May 1939 – 12 May 1945

Unit	Emergency Centre
Region	Scottish Borders
NGR	NT 4896 3631 (Town Hall, Galashiels)
NMRS	NT43NE 133

During 1936 the Air Ministry drew up plans to extend the Observer Corps system to cover the whole of Great Britain, but more immediately to cover the area between the Rivers Tees and Tay with the formation of two new Observer Groups, one extending from the Tees to the Tweed and one from the Tweed to Dundee. The latter was to be numbered No 31 Observer Group with the Observer Centre in Edinburgh. Although the suggestion to form these additional Groups came from the Home Office, the Air Ministry considered that such an extension to the Corps was likely to become desirable on operational grounds. The estimated cost was £5,500 for the two Groups, plus £1,800 annual maintenance costs. Treasury approval for this was given on 6 February 1937 (TNA, AIR 2/1772).

In December 1936 the location proposed by Fighter Command for the Observer Centre for No 31 Group was changed from Edinburgh to Dunfermline, However in a letter dated 2 March 1938, Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command noted:

> *The area of No 31 Observer Group was originally fixed to include both sides of the Firth of Forth, and the Group has been formed accordingly. This division of the area by the Firth of Forth causes considerable difficulty from the communication and administrative points of view, and it is thought that the further expansion of the Observer Corps in Scotland … provides a good opportunity of overcoming this difficulty.*
>
> *My proposals, therefore, are as follows:-*
>
> *No 31 Observer Group to lose 12 Posts North of the Firth of Forth, but to be increased by some of the Posts that were to be allocated to No 34 Observer Group. A new Centre at Galashiels to operate No 31 Group as from the 31st March 1939.*



63 Galashiels Centre, circa 1939 (© The Scotsman).

> *No 34 Group to be diminished in size with a new Centre instead of Galashiels, for which Lanark is suggested.*
>
> *No 35 Group to be formed in 1940 instead of 1939.*
>
> *No 36 Group to be formed in 1939 instead of 1940. The area to be enlarged to include 12 Posts North of the Firth of Forth now in No 31 Group. The existing No 31 Group Centre at Dunfermline to be made the Centre for No 36 Group and to operate as such from the 31st of March 1939* (TNA, AIR 2/1772).

The Corn Exchange in Galashiels was taken over for use as the Observer Centre of No 31 Group (Wood, 1992: 271) which, as noted by Air Chief Marshal Dowding above, formed in early 1938 (TNA, AIR 2/1772). Galashiels Centre had an authorised establishment of 120; by the second week of February 1939 only 37 had volunteered (*The Southern Reporter*, 16 February 1939). No 31 Group did not become operational until 9 May 1939 (TNA, AIR 16/48). At the time, the hall was used as a warehouse by Read, Simpson & Company, wool merchants, and this was rented from them by the Observer Corps (Valuation Roll, 86 Overhaugh Street, 1942-43). The Corn Exchange itself had been built in Galashiels in 1860 at a cost of £1,100. It had a hall with accommodation for 500 persons (Groome, 1901: 627), which was used during the 1890s by the Salvation Army (Valuation Roll, 86 Overhaugh Street, 1895-96 and 1897-98) but Read, Simpson & Company were using it as a wool store by the start of the First World War (Valuation Roll, 86 Overhaugh Street, 1914-15). The Emergency Centre for 31 Group was in the Town Hall in Galashiels (Wood, 1992: 271).

Before then, selection of sites for Observer Posts had already begun, with this process starting in February 1937 (TNA, AIR 2/20017, AIR 2/20018, AIR 2/20020, AIR 2/20032, AIR 2/20033, AIR 2/20034) and continuing through into 1939, with for example, the selection of the North Berwick Post at Castle Hill, starting on 20 February 1937 but the form of agreement not being signed with the Town Council until 8 February 1939 (TNA, AIR 2/20018). This is typical of the lead-in time required during peacetime so that Posts were operational for the opening of the Centre in May 1939, although some were arranged more quickly. The selection of Peebles Post, for example, only began in November 1938 but agreement to the Post, with erection of a hut, was given by the Town Council on 10 February 1939 (TNA, AIR 2/20026).

No 31 Observer Group has the distinction of plotting the first enemy aircraft to be seen over the UK during the Second World War, on a reconnaissance flight prior to the air attack on ships in the Firth of Forth on 16 October 1939. The identification of the aircraft as hostile was not initially accepted, but the Observer Posts concerned were proved correct. The first German aircraft brought down on mainland Britain, a Heinkel He 111 shot down at Kidlaw in East Lothian, was fully tracked from the time it entered the area of No 31 Group (Winslow, 1948: 179-180).

Major Robert Cecil Blackwood MC was Observer Group Officer of No 31 Group and Thomas Lees was the Centre Controller (Wood, 1992: 271). Thomas M Lees was a Director with George Lees & Co Ltd, tweed manufacturers at Galabank Mill, and was awarded an MBE in January 1941 for his services to the Corps (*The Southern Reporter*, 16 January 1941).

The Observer Posts within No 31 Group were as follows:

A.1	North Berwick	NT 560 852 (9 May 1939 – 12 May 1945)
A.2	Athelstaneford	NT 532 767 (9 May 1939 – 12 May 1945)
A.3	Aberlady	NT 464 800 (9 May 1939 – Dec 1943)
A.3	Aberlady	NT 474 828 (Dec 1943 – 12 May 1945)
B.1	Dunbar	NT 689 783 (9 May 1939 – 12 May 1945)
B.2	Innerwick	NT 727 735 (9 May 1939 – 15 Jul 1942)
B.2	Innerwick	NT 74767248 (15 Jul 1942 – 12 May 1945)
B.3	Garvald	NT 587 710 (9 May 1939 – 12 May 1945)
C.1	Grantshouse	NT 814 651 (9 May 1939 – Oct 1939)
C.1	Grantshouse	NT 816 649 (Oct 1939 – 12 May 1945)
C.2	Eyemouth	NT 93056451 (9 May 1939 – 12 May 1945)
C.3	Chirnside	NT 878 572 (9 May 1939 – 12 May 1945)
D.1	Longformacus	NT 686 580 (9 May 1939 – 12 May 1945)
D.2	Duns	NT 793 542 (9 May 1939 – 12 May 1945)
D.3	Westruther	NT 643 496 (9 May 1939 – 12 May 1945)

E.1	Coldstream	NT 841 405 (9 May 1939 – 12 May 1945)
E.2	Morebattle	NT 774 245 (9 May 1939 – 12 May 1945)
E.3	Kelso	NT 729 352 (9 May 1939 – Aug 1942)
E.3	Kelso	NT 727 348 (Aug 1942 – 12 May 1945)
F.1	Gordon	NT 653 431 (9 May 1939 – 12 May 1945)
F.2	Jedburgh	NT 6351 1959 (9 May 1939 – 12 May 1945)
F.3	St Boswells	NT 569 312 (9 May 1939 – 12 May 1945)
G.1	Ashkirk	NT 472 224 (9 May 1939 – 12 May 1945)
G.2	Bonchester Bridge	NT 577 123 (9 May 1939 – 12 May 1945)
G.3	Teviotdale	NT 408 054 (9 May 1939 – 12 May 1945)
G.4	Lilliesleaf	NT 524 276 (9 May 1939 – 12 May 1945)
H.1	Stow	NT 467 450 (9 May 1939 – 12 May 1945)
H.2	Yarrow	NT 342 261 (9 May 1939 – 12 May 1945)
H.3	Peebles	NT 245 410 (9 May 1939 – 12 May 1945)
H.4	Clovenfords	NT 442 361 (Jul 1940 – 12 May 1945)
J.1	Humbie	NT 457 632 (9 May 1939 – 12 May 1945)
J.2	Lauder	NT 527 469 (9 May 1939 – 12 May 1945)
J.3	Heriot	NT 399 547 (9 May 1939 – 12 May 1945)
K.1	Balerno	NT 151 669 (9 May 1939 – 12 May 1945)
K.2	Penicuik	NT 238 603 (9 May 1939 – 12 May 1945)
K.3	West Linton	NT 147 514 (9 May 1939 – 12 May 1945)
K.4	West Calder	NT 028 623 (9 May 1939 – 12 May 1945)
L.1	Bo'ness	NS 993 807 (9 May 1939 – May 1942)
L.1	Bo'ness	NS 998 811 (May 1942 – 12 May 1945)
L.2	Winchburgh	NT 099 748 (9 May 1939 – 12 May 1945)
L.3	Bathgate	NS 984 688 (9 May 1939 – 12 May 1945)
M.1	Granton	NT 238 776 (9 May 1939 – Sep 1940)
M.1	Granton	NT 2505 7686 (Sep 1940 – 12 May 1945)
M.2	Tranent	NT 408 734 (9 May 1939 – 12 May 1945)
M.3	Dalkeith	NT 348 666 (9 May 1939 – 12 May 1945)

(TNA, AIR 2/19638, AIR 2/19661, AIR 2/20017, AIR 2/20018, AIR 2/20019, AIR 2/20020, AIR 2/20024, AIR 2/20026, AIR 2/20030, AIR 2/20031, AIR 2/20032, AIR 2/20033, AIR 2/20034, AIR 2/20317; Wood, 1992: 325-326, 330-331, 333-334; Alastair Redpath, pers comm).

Two Observer Posts within 31 Group, Jedburgh (Post F.2) and Ashkirk (Post G.1) were involved in plotting the flight of Rudolf Hess. Thomas Lees, the Centre Controller at Galashiels, noted in a letter to the ROC Commandant

on 13 May 1941 that Post F.2 "just got a glimpse of this in the clouds and reported it as probably a Me 110." In his report the Scottish Area Commandant noted that "this plane was identified as a Me 110 by F.2 Post Jedburgh and G.1 Ashkirk, but both Group and Sector insisted that it must be a Dornier 215" (TNA, AIR 16/1266). Jedburgh and Ashkirk Posts earned a special commendation from Headquarters Fighter Command for their correct identification of the aircraft as a Messerschmitt Bf 110:

> *I am to ask that you will request the Commandant to convey to the crews of the Posts who were on duty at that time at:-*
>
> *A.3 Chatton*
> *F.2 Jedburgh*
> *G.1 Ashkirk*
>
> *the Chief of the Air Staff's appreciation of their work. The accuracy with which the aircraft was identified is commendable, having regard to the fact that the appearance of an Me 110 in these areas was most unusual* (TNA, AIR 16/1266).

The new position of Group Commandant was created in 1943 and that of Observer Group Officer deleted. The Group Commandant for No 31 Group from 1943 to 1945 was Observer Commander JR Dickenson (Wood, 1992: 271), a peace-time solicitor (*The Southern Reporter*, 2 March 1944). The former OGO, Major Robert Cecil Blackwood MC, moved to become Group Commandant of No 36 Group at Dunfermline (Wood, 1992: 270).

Galashiels Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181), but a skeleton staff of full-time members was maintained at Galashiels Centre (*The Southern Reporter*, 24 May 1945).

Glasgow

Unit	Observer Centre
Region	Glasgow City
NGR	NS 5824 6543 (New Telephone House, 65-95 Pitt Street, Glasgow)
NMRS	NS56NE 1443
In use	6 June 1939 – 12 May 1945

Unit	Emergency Centre
Region	Glasgow City
NGR	NS 5863 6544 (89 Wellington Street, Glasgow)
NMRS	Not allocated

Plans were drawn up by the Air Ministry to extend the Observer Corps system to cover the whole of Great Britain. More immediate plans were for cover for

the area between the Rivers Tees and Tay. Between the Tweed and Dundee was to be covered by No 31 Observer Group, initially with its Centre in Edinburgh, then in December 1936 the proposed Centre was moved from Edinburgh to Dunfermline. The original area for the Group included both sides of the Firth of Forth and, due to communications difficulties, it was proposed by Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command, on 2 March 1938 that this be changed:

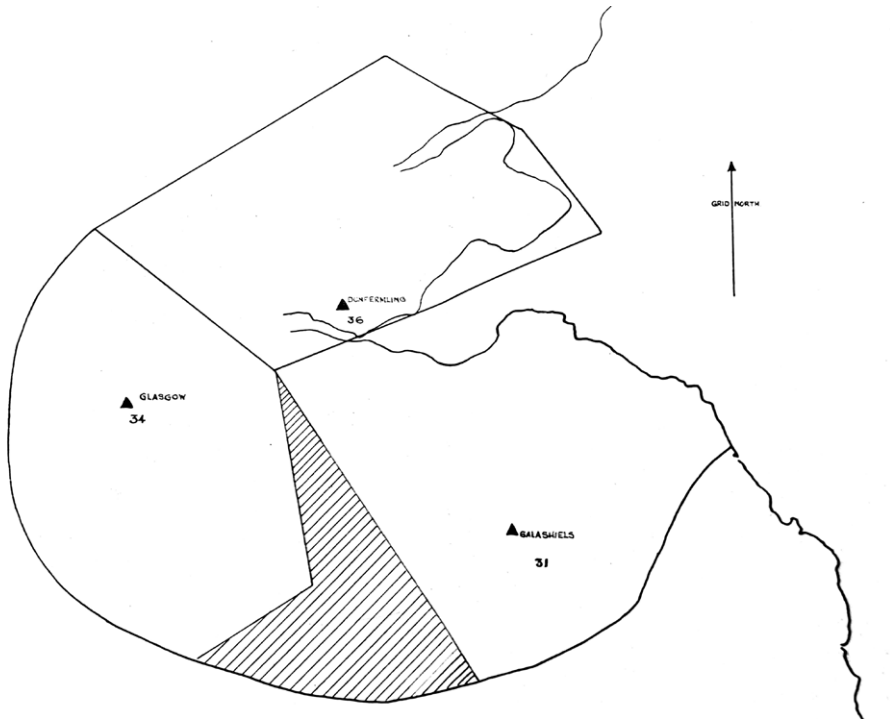
> *No 31 Observer Group to lose 12 Posts North of the Firth of Forth, but to be increased by some of the Posts that were to be allocated to No 34 Observer Group. A new Centre at Galashiels to operate No 31 Group as from the 31st March 1939.*
>
> *No 34 Group to be diminished in size with a new Centre instead of Galashiels, for which Lanark is suggested* (TNA, AIR 2/1772).

These proposals were approved by Air Vice-Marshal Charles Portal, Director of Organisation at the Air Ministry, on 15 March. There were, however, issues in establishing posts in much of the area proposed for No 34 Observer Group because the sole telephone exchange in that part of Scotland had only one outlet and therefore it was not possible to provide telephone lines to Posts in the area. Air Chief Marshal Dowding therefore wrote to the Air Ministry on 16 June 1938 with the following proposals:

> *I recommend that no further steps should be taken with a view to establishing Posts in this shaded area and that a further shifting of the Groups in this area should take place whereby the Posts originally allowed for No 35 Group should be taken in by No 34 Group, thus doing away with one Group altogether. The programme suggested would therefore be:-*
>
> | | |
> |---|---|
> | *1939* | *Form No 36 Group – Existing Centre in Dunfermline.* |
> | | *Extend the area of No 31 Group – New Centre in Galashiels.* |
> | *1940* | *Form No 34 Group – Centre in Glasgow.* |
> | | *Form No 37 Group – Centre in Dundee.* |
> | *1941* | *Form No 38 Group – Centre in Aberdeen* (TNA, AIR 2/1772). |

Air Chief Marshal Dowding's proposals were approved by the Air Ministry on 12 July 1938 and No 34 Observer Group became operational on 6 June 1939 (TNA, AIR 2/1772), with the Observer Centre at New Telephone House, Pitt Street (TNA, AIR 20/5357). The Centre Controller was Major RB Wharrie, MC (Wood, 1992: 272), and the Observer Group Officer was Colonel John Kennedy (TNA, AIR 2/20039, 2/20319).

Siting selection for Observer Posts had begun back in December 1938, with for example the roof of the J & P Coats offices in 155 St Vincent Street being chosen for Glasgow Post. The Scottish Area Commandant, Air Commodore R Peel Ross, wrote to the company on 22 December 1938:



64 Revised layout proposed in June 1938 for Nos 31, 34 and 36 Groups, Observer Corps, with the shading showing the area without telephonic facilities (TNA, AIR 2/1772).

A system of Observer Posts manned when necessary by local Special Constables, forms an important part of the arrangements for the Air Defence of Great Britain. By this means information would be given to Headquarters, Air Defence of Great Britain as to the movements of any hostile aircraft entering these shores.

It is desired to establish such a Post at Glasgow, and a suitable site has been located on the flat top of your premises at 155 St Vincent Street, Glasgow. The exact site is known to Mr Guthrie. If permission is granted, the site would only be used in peace time for Annual Exercises, not exceeding 7 days (or nights) per annum. As the equipment is portable, nothing remains on the site when not in use. When the portable gear, consisting of a tripod stand, etc, is set up, a telephone wire is led away to a connection provided by the GPO. When the exercise is finished (these take place usually in June), the cable is disconnected, and the gear is packed up by members of the Observer Corps and removed from the site.

No damage of any sort occurs, and it may perhaps be mentioned that the men manning the Post are always local men, known probably to you, and that in the quite large number of Posts already established, no difficulties with Landlords

> *or Tenants have been found to occur. The Chief Constable of Glasgow would be able to give you any further assurances you may require on the general working of this scheme.*
>
> *Will you please let me know if you agree to a Post being established on your property as desired* (TNA, AIR 2/20039).

A reply was sent by J & P Coats on 28 December confirming their agreement to the Post at 155 St Vincent Street which was set up in 1939 (TNA, AIR 2/20039).

A memoranda, believed written by the Observer Group Officer of No 39 Observer Group, Inverness, JOA Fraser-Mackenzie, in October 1940 noted:

> *Glasgow Centre is fortunate in having some of the best business brains of the City amongst its members and some Posts are manned almost entirely by retired senior officers and retired officials of high standing. This of course is … in order to utilise the most competent brains available* (TNA, AIR 2/20141).

The Observer Posts within No 34 Group were as follows:

A.1	Aberfoyle	NN 520 014 (June 1939 – May 1945)
A.2	Kippen	NS 637 945 (June 1939 – May 1945)
A.3	Killearn	NS 528 863 (June 1939 – May 1945)
B.1	Kilsyth	NS 722 779 (June 1939 – May 1945)
B.2	Slamannan	NS 861 732 (June 1939 – May 1945)
B.3	Airdrie	NS 775 644 (June 1939 – May 1945)
C.1	Shotts	NS 870 606 (June 1939 – Sep 1941)
C.1	Shotts	NS 879 611 (Sep 1941 – May 1945)
C.2	Forth	NS 937 540 (June 1939 – May 1945)
C.3	Carluke	NS 857 493 (June 1939 – May 1945)
D.1	Dunsyre	NT 080 485 (June 1939 – May 1945)
D.2	Broughton	NT 111 358 (June 1939 – May 1945)
D.3	Thankerton	NS 972 376 (June 1939 – May 1945)
E.1	Douglas	NS 847 309 (June 1939 – May 1945)
E.2	Lesmahagow	NS 799 384 (June 1939 – May 1945)
E.3	Abington	NS 928 238 (June 1939 – May 1945)
F.1	Muirkirk	NS 697 279 (June 1939 – May 1945)
F.2	Darvel	NS 571 380 (June 1939 – May 1945)
F.3	Catrine	NS 529 261 (June 1939 – May 1945)
F.4	Kilmarnock	NS 443 388 (June 1939 – 2 Dec 1941)
F.4	Strathaven	NS 709 442 (2 Dec 1941 – May 1945)

G.1	Beith	NS 341 550 (Aug 1940 – May 1945)
G.2	Irvine	NS 305 386 (Jul 1940 – May 1945)
G.3	West Kilbride	NS 201 483 (Jul 1940 – May 1945)
H.1	Barrhead	NS 486 591 (June 1939 – May 1945)
H.2	Eaglesham	NS 562 514 (June 1939 – Aug 1939)
H.2	Eaglesham	NS 558 519 (Aug 1939 – May 1945)
H.3	Dunlop	NS 398 497 (June 1939 – May 1945)
H.4	Strathaven	NS 709 442 (June 1939 – 2 Dec 1941)
H.4	Kilmarnock	NS 443 388 (2 Dec 1941 – May 1945)
J.1	Stepps	NS 659 695 (June 1939 – May 1945)
J.2	Bothwell	NS 698 588 (June 1939 – May 1945)
J.3	Glasgow	NS 5863 6549 (June 1939 – May 1945)
K.1	Alexandria	NS 405 799 (June 1939 – May 1945)
K.2	Milngavie	NS 547 744 (June 1939 – May 1945)
K.3	Bridge of Weir	NS 386 650 (June 1939 – May 1945)
L.1	Gourock	NS 238 771 (June 1939 – May 1945)
L.2	Skelmorlie	NS 199 671 (June 1939 – May 1945)
L.3	Kilchattan	NS 088 547 (Dec 1940 – Mar 1941)
L.3	Rothesay	NS 100 644 (Mar 1941 – May 1945)
L.4	Kames	NR 969 703 (28 Dec 1941 – July 1943)
L.4	Kames	NR 984 748 (July 1943 – May 1945)
M.1	Clachan	NR 745 548 (May 1941 – May 1945)
M.2	Glenbarr	NR 671 371 (May 1941 – May 1945)
M.3	Machrihanish	NR 628 208 (May 1941 – Jul 1942)
M.3	Machrihanish	NR 635 206 (Jul 1942 – May 1945)
M.4	Carradale	NR 8169 3828 (May 1941 – May 1945)
N.1	Brodick	NS 032 353 (May 1940 – May 1945)
N.2	Kildonan	NS 039 219 (May 1941 – May 1945)
N.3	Drumadoon	NR 895 292 (May 1941 – May 1945)

(TNA, AIR 2/20015, AIR 2/20021, AIR 2/20022, AIR 2/20023, AIR 2/20035, AIR 2/20036, AIR 2/20037, AIR 2/20038, AIR 2/20039, AIR 2/20040, AIR 2/20042, AIR 2/20043, AIR 2/20044, AIR 2/20045, AIR 2/20046, AIR 2/20047, AIR 2/20048, AIR 2/20049, AIR 2/20055, AIR 2/20088, AIR 2/20319; *Milngavie and Bearsden Herald*, 3 June 1944; Wood, 1992: 323-327, 329-332, 334).

No 34 Group is probably best remembered for its involvement in the flight of Rudolf Hess, the Deputy Führer of Nazi Germany, to Scotland on 10 May 1941. Major Graham Donald, one of the Assistant Observer Group Officers, was on duty

that night and submitted a detailed report to the Scottish Area Commandant of the Royal Observer Corps the following day:

I have the honour to report as follows, upon the German aircraft plotted and crashed in 34 Obs Group about 23.00hrs on Saturday 10th May.

The first visual plot given in 34 Group was from G.3 (West Kilbride). It was nearly dark and not much detail could be seen. I was in Centre at the time and spoke to G.3. They gave it as a twin-engine, twin-rudder aircraft. Might be a Dornier 215. Plane was then low over the Clyde, heading south. Then plotted inland, east and then north, heading for Glasgow. There was a Defiant to the s[outh] *of him, but it did not seem fast enough. I suggested that the EA* [enemy aircraft] *might therefore be a Me 110. One of the H posts thought this likely.*

H.2 (Eaglesham) reported EA crashed in flames near Bonnytown Moor. As this was only a few miles south, I proceeded rapidly by car to the spot. There I was fortunate enough to intercept the pilot, who had baled out. The Home Guard took him to their HQ where I managed to meet them later.

I made a careful examination of the wreckage, which was spread over about 1½ acres. The following conclusions were made (open, of course, to confirmation in daylight).

(a) The plane was a 'stripped' Me 110.
(b) No guns, bomb-racks and surprisingly (at the time), I could find no fixed reconnaissance camera.
(c) The petrol fire was not tremendous. It appeared as if he had not any great quantity of petrol left.
(d) The aircraft, accessories, parachute, etc were all brand new.

I found the pilot and the HG [Home Guard] *HQ surrounded by HG, Police and an interpreter. They did not, by then, appear to be making great headway. He simply stated that he had not been hit, was in no trouble, and had landed deliberately, with a vital secret message for the Duke of Hamilton. He hoped he was close to Dungavel House, the Duke's place. He shewed it to me, marked on his map. Actually he landed only about 20 or 30 miles from his alleged objective.*

I manged to dig up enough German to get a bit more out of him.

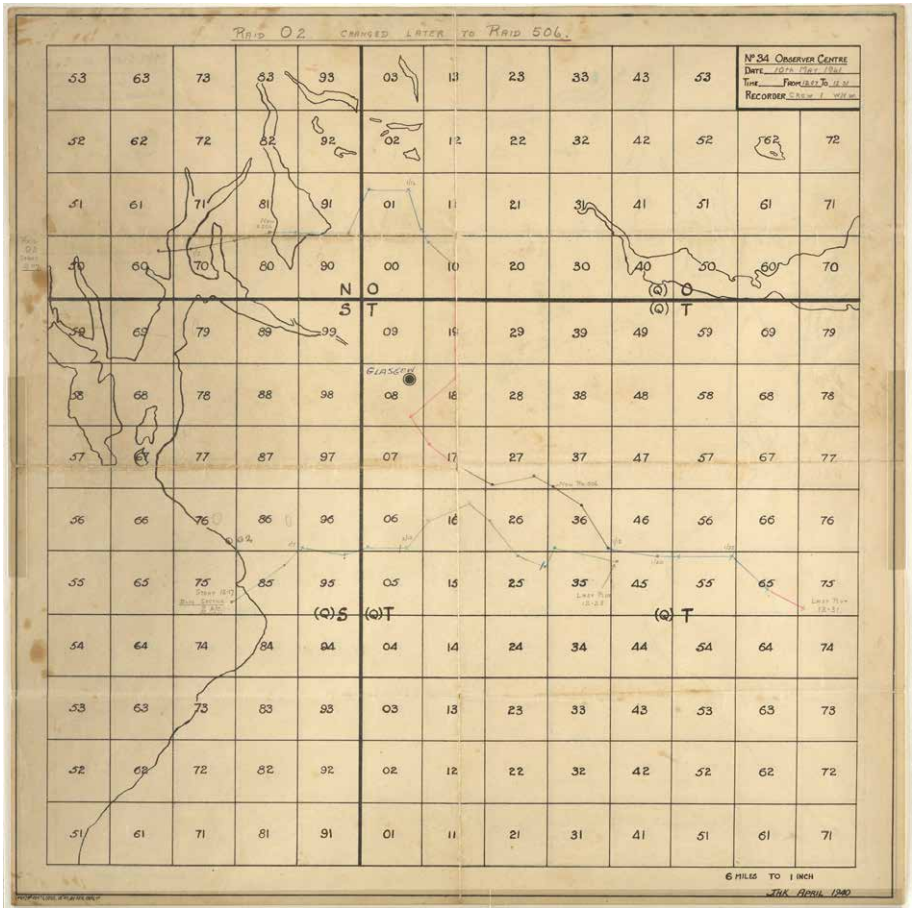
He said he had left solo that evening from Munich. I pointed out that even with extra tanks he could not have got back, after starting right in south Germany. He agreed and repeated that he was on a special mission and had not intended to get back.

He gave me his name as Hauptmann (Captain) Alfred Horn, age 42, and he is, if one may apply the term to a Nazi, quite a gentleman. His face was very familiar to me and we discussed Munich, to which city he belongs, and which I have visited.

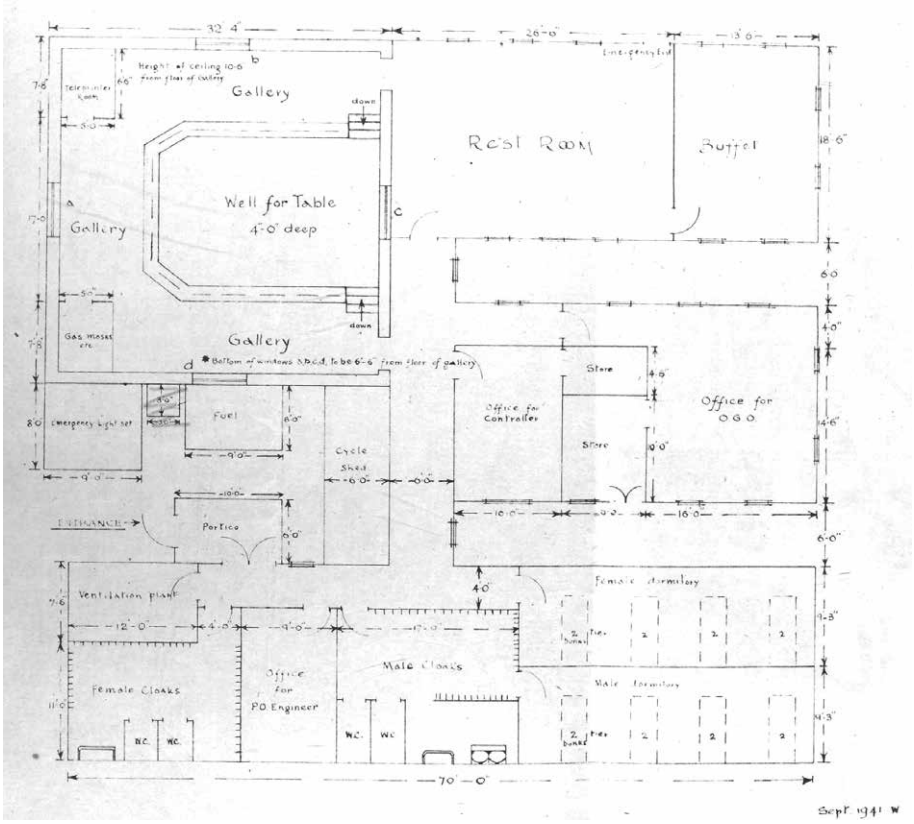
I studied his face, while conversing, for a few minutes. I then remembered it. I am not expecting to be believed immediately that our prisoner is actually No 3 in the Nazi hierarchy. He may be one of his 'professional doubles'. Personally I think not. The name may be Alfred Horn, but the face is the face of Rudolf Hess.

I have no doubt that our intelligence people will check up carefully on his story, or 'mission', and it is to be hoped that the Duke of Hamilton will manage to have a talk with him, as he claims to be personally acquainted with the Duke.

I found him to be a very interesting and quite pleasant fellow, not in the least of the 'tough' young Nazi type, but definitely an officer who may well be a very important man in higher Nazi circles.



65 Plotting map from No 34 Observer Group, showing the track of Hess' aircraft on 10 May 1941, confused at one point with a Boulton Paul Defiant attempting to intercept (museum number EF.1999.22 © Trustees of National Museums Scotland).



66 Plan of proposed purpose-built Observer Centre (TNA, AIR 20/5357).

> *I trust that this brief report may be of interest, even as a purely Royal Observer Corps matter. I feel that it should be on record that this plane was well tracked and plotted, visually identified after dusk, place of crash immediately plotted and (I hope) the pilot identified, all by 34 Group of the ROC* (TNA, AIR 16/1266).

In January 1942 proposals were discussed between ROC HQ and the Air Ministry regarding work required to complete Emergency Centres. This noted that it remained necessary to provide the Emergency Centre for No 34 Group in Wellington Street and completely equip it. The basement of the Athenaeum Club had also been requisitioned but this too required the completion of some work (TNA, AIR 20/5357).

On 17 February 1942, a meeting was held at the Air Ministry in London to discuss ROC Centres. This meeting proposed the construction of purpose-built standardised brick ROC Centres with walls and roof that were blast, splinter and incendiary-bomb proof, and included an operations room measuring 32 feet 4 inches square. (TNA, AIR 20/5357). It was agreed in January 1944 to build one of these new Centres in Glasgow, but by April this was in question, despite the ROC considering the new Centre to be essential,

with the projected cost having increased from £1,950 to £2,760. At the time No 34 Group was operating from the Emergency Centre in Wellington Street and it was noted that this was not satisfactory and if the scale of attack increased (it was negligible at that time) or the Emergency Centre had to continue operating for a long time, it would be necessary to build the new Centre. The Air Ministry therefore suggested that whilst the proposal to build the new Centre could not be abandoned, it should be delayed, particularly until after the D-Day landings by which time a greater understanding of the need for the Centre would be clear. Although Observer Commander PH Whitfield, working in the Directorate of Operations (Air Defence) at the Air Ministry, suggested on 15 April 1944 that it was necessary to proceed with the new Centre (TNA, AIR 20/5358), this was not sanctioned and the new Centre was not built.

The new position of Group Commandant was created in 1943 and Observer Group Officer deleted. The Group Commandant for No 34 Group was from 1943 to 1944 Observer Commander Sir Windham EF Carmichael-Anstruther Bart DSO, DL, JP and from 1945 to 1950 Observer Commander J Hartley (Wood, 1992: 272).

Glasgow Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Ingliston

Unit	Sub-Gun Operations Room
Region	City of Edinburgh
NGR	NT 1443 7276 (Ingliston House)
NMRS	NT17SW 161
In use	circa March 1942 – 19 November 1942

On 2 March 1942 approval was received for the formation of two Sub-GORs in Forth Gun Defended Area. Locations for the two Sub-GORs were approved one week later, with one located at Ingliston House (TNA, WO 166/7393), designated as Sub-Gun Operations Room 8 (TNA, WO 212/81). Ingliston House was built in 1846 from pale grey ashlar stone in an eccentric Scottish Baronial style. It was designed by Brown & Wardrop (McWilliam, 1978: 260).

On 19 November 1942 the Forth Sub-GORs were ordered to close down forthwith and all anti-aircraft gun sites were to be controlled by the main GOR at Craigiehall (TNA, WO 166/7309).

Invergordon

Unit	Gun Operations Room
Region	Highland
NGR	NH 7268 6996 (Saltburn)
NMRS	Not allocated
In use	1940 – circa 1945

36th AA Brigade Operation Order No 1, dated 2 September 1939, noted that the Officer Commanding 297th AA Battery had been appointed AADC Invergordon and would be in operational command of all HAA and LAA units in the area (TNA, WO 166/2264). On 13 September 1939 a house in Saltburn was requisitioned by 297th AA Battery as the Battery HQ with Lieutenant Colonel JA Mackintosh as AADC. On 29 September No 2 Gun Station of 297th Battery reported to Operations Room Invergordon and RAF Evanton that an unidentified aircraft had been observed. After circling, the aircraft disappeared on a bearing of 318º at 11,000 feet (TNA, WO 166/2328).

Orders were received by 3rd Anti-Aircraft Division from AA Command on 26 January 1940 for a reconnaissance to be carried out for HAA, LAA and searchlight layouts for the AA defence of the Contraband Control Anchorage at Invergordon (TNA, WO 166/2128).

On 19 March 1940 Brigadier AD Macpherson, Officer Commanding 36th AA Brigade, along with Lieutenant Colonel JA Mackintosh, AADC, visited two possible headquarters for Invergordon Gun Operations Room (TNA, WO 166/2328). 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 notes that 'Satellite' Gun Operations Rooms serving one, two or more Heavy Anti-Aircraft gun sites and one or more Light Anti-Aircraft Troop HQs included Invergordon (TNA, WO 166/2129).

302 Gun Operations Room, a Class 'B' GOR, was operating in Invergordon on 14 May 1942 (TNA, WO 212/81) and 1 October 1942 (TNA, WO 212/82).

Inverkip

Unit	Gun Operations Room
Region	Inverclyde
NGR	NS 2146 7170 (Langhouse)
NMRS	NS27SW 16
In use	3 March 1942 – circa 1945

Two telephone lines between Clyde GOR and 'F' Sub-GOR at Inverkip were completed on 15 January 1942 (TNA, WO 166/7371). 335 Gun Operations Room, a Class 'B' GOR, opened in Langhouse on 3 March 1942, with the responsibility to tell all aircraft movements in the area to GOR Clyde (TNA, WO 166/2213, WO 166/7371, WO 212/81, WO 212/82).

Langhouse was built around 1848, in a Gothic style richly covered with turrets, around the core of a farmhouse dating from 1705 (Walker, 1986: 144). In 1940 it was owned and occupied by Kenneth Laurie MacFie, an engineer (Valuation Roll, Langhouse, 1940-41).

Soon after 3 January 1943 Inverkip became the GOR for the Greenock Gun Defended Area (TNA, WO 166/11216). Lieutenant Colonel GH Philip was AADC at 'F' Sub-GOR until 12pm on 2 February 1943, moving to be AADC at 'E' Sub-GOR at Johnstone. He was replaced as AADC at 'F' Sub-GOR by Lieutenant Colonel Sir JA Ruggles-Brise (TNA, WO 166/11216). At 20 February 1944 the Commanding Officer was Captain W Blackwell (TNA, WO 166/14638).

Inverness

Unit	Fighter Group HQ
Region	Highland
NGR	NH 7052 4286 (Drumossie Hotel)
NMRS	NH74SW 19
In use	14 October 1940 (Operations Room), 22 October 1941 (Filter Room) – 28 February 1943 (Operations Room), 11 May 1943 (Filter Room)

Unit	Fighter Group Operations Block
Region	Highland
NGR	NH 6822 4540 (Raigmore Ops Block, Air Ministry Drawing No 6877/41)
NMRS	NH64NE 277
In use	1 March 1943 – 7 April 1944

Unit	Fighter Group Filter Block
Region	Highland
NGR	NH 6826 4560 (Raigmore Filter Block, Air Ministry Drawing No 4820/41)
NMRS	NH64NE 642
In use	12 May 1943 – 15 March 1946

Unit	Fighter Group Signals Block
Region	Highland
NGR	NH 6866 4556 (Raigmore Signals Block, Air Ministry Drawing No 9943/41)
NMRS	Not allocated
In use	1 March 1943 – date unknown

On 19 November 1936, a licence was granted for a new up-to-date hotel to be built at Bogbain, four miles south of Inverness, by Lochness Hotels Ltd. The need for the hotel was due to the growth in the tourist industry in Inverness over the preceding two years (*Press and Journal*, 20 November 1936). New plans for the hotel were approved in October 1938 by Inverness District Licensing Court, with the estimated cost of construction being £20,000. The architect, William Taylor, noted that UK re-armament made it difficult to obtain steel and consequently all steel work was dispensed with in the design of the building (*Press and Journal*, 26 October 1938). William Taylor had his own practice, WJ Taylor & Co, with its offices at 28 Church Street in Inverness (Valuation Roll, Church Street, Inverness, 1940). Construction of Drumossie Hotel finally began in early 1939 (*Press and Journal*, 1 March 1939) in the art deco style. The hotel was requisitioned by the Air Ministry in 1940 (*The Scotsman*, 30 December 1946). No 14 (Fighter) Group Headquarters formed at Drumossie Hotel on 29 June 1940 and took administrative control of the units within the Group area on 30 August 1940.

Acting Flight Lieutenant Rom Landau was posted to No 14 Group HQ on 9 August 1940 for Ops Room duties (TNA, AIR 25/250). He recalls his arrival at Drumossie:

> *I arrived before nine o'clock. Except for the carpenters, electricians and plumbers and a few airmen, no-one seemed to be present. I walked through several rooms, most of them unfinished, white dust lying inch-deep on floors and scattered pieces of furniture. The Ops Room itself was hardly begun and it would probably be weeks before it was in working order … After ten, several officers arrived at HQ, and by eleven someone suggested that I should join two officers who were closeted together in one of the few finished rooms. Both of them, one a Wing Commander, the other a Squadron Leader, were doing administrative duties in HQ. Though I offered to do any job whatsoever, from typing letters to filing documents, they were unable to find any work for me* (Landau, 1945: 277).

Acting Flight Lieutenant Landau was the duty officer on Sunday 7 September 1940, when the codeword 'Cromwell', indicating a German invasion was imminent, was accidentally distributed (Barclay, 2013: 57). He wrote about the incident in his diary:

> *A few hours ago, at six-fifteen to be precise, the duty sergeant from the signals room handed me an urgent cipher that had just arrived. It was quite short and I decoded it within a few minutes. When I had finished the job and re-read the message, for a second or two everything seemed to swim before my eyes. For weeks past, this very message had been the subject of many speculations on the part of every duty or signals officer. We had all agreed that once this message arrived, German invasion was imminent. The most secret safe at HQ, to which the duty officer alone had the key, contained a sealed envelope the contents of which were unknown to anyone, even to AOC, and which was to be opened by him personally after a certain signal had arrived. The cipher that I had decoded contained the instructions for this.*
>
> *Being a Sunday, no officer senior to myself was present at HQ, so I unlocked the safe, removed from it the insignificant yet strangely ominous-looking envelope and made sure that it really bore the symbols corresponding to those contained in the decoded cipher. After I had reassured myself, I rang up the AOC's hotel in town. "The Air [Vice-]Marshal has given instructions not to be disturbed," I was informed. "It is most urgent and I must speak to him instantly," I insisted, and the tone of my voice must have sounded convincing, for a few seconds later I heard the Air [Vice-]Marshal's slightly impatient voice. "What is it?" Since the telephone line connecting HQ with the hotel was not a secret one, I didn't dare to give him full details. "A most important signal has come through," I therefore said, "which, I'm afraid, sir, calls for your immediate presence at HQ." "I'll be there within a few minutes," he replied, and exactly twelve minutes later his big*

car drove up at HQ. Even before he had had time to take off his hat and greatcoat I went into his room and handed him the sealed envelope. Did I imagine that his expression was more tense than usual?

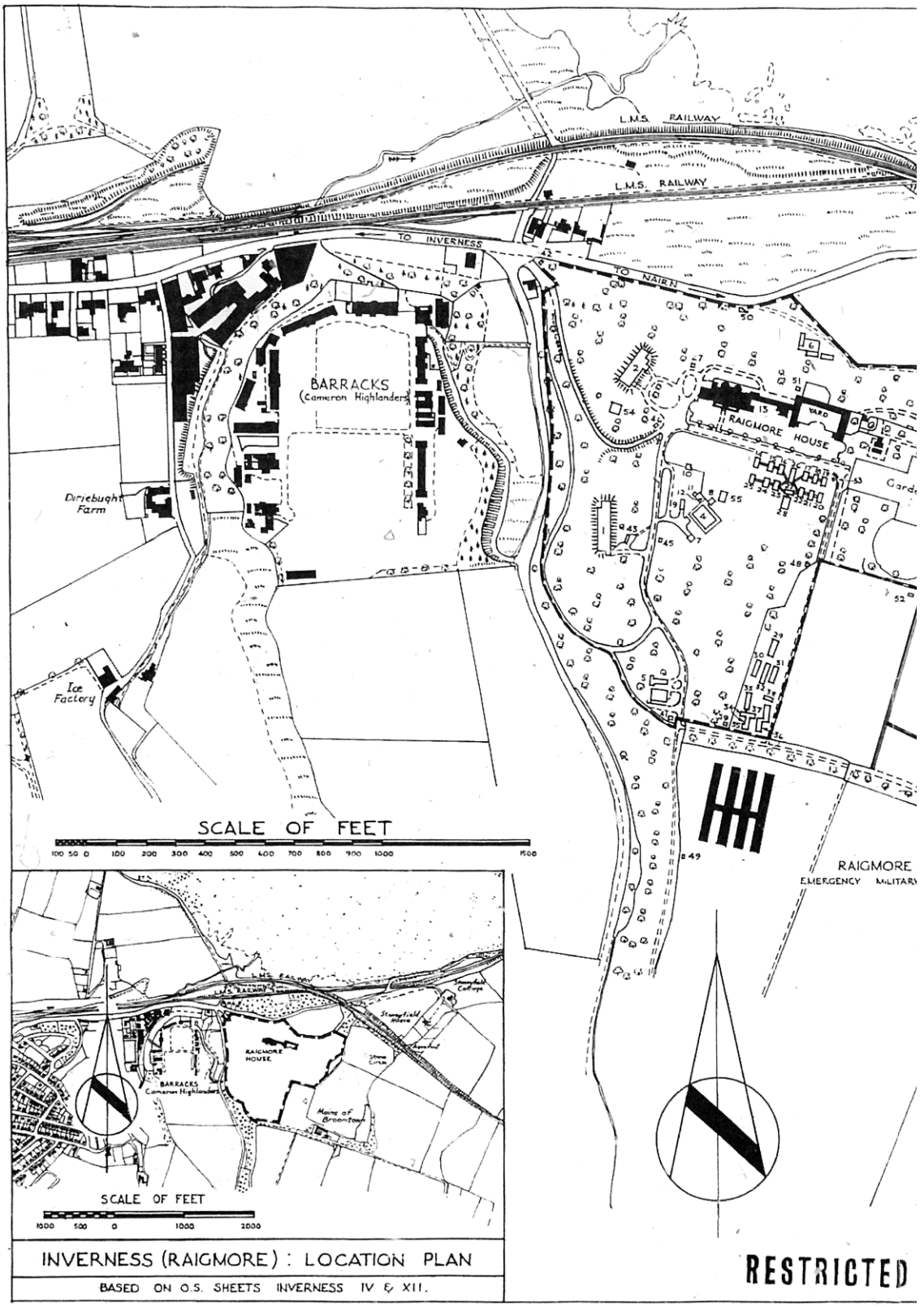
Within half an hour, two of the other senior officers appeared at HQ, the guards round our building were doubled and all the men were issued with rifles. No officer was to walk about inside or outside HQ without his revolver. Oh God, I mumbled to myself, stupidly and selfishly, let something really happen at last.

By nine o'clock the senior officers departed again and I am now the only officer left at HQ … It is past midnight and I can hear the guards walking up and down outside the building and exchanging an occasional joke … No guns, no sirens, no church bells, nothing (Landau, 1945: 291-292).

On 14 October 1940 the Group HQ took over operational control of the units within the Group area (TNA, AIR 25/250) and the Operations Room became operational at Drumossie Hotel. On 22 October 1941 No 14 (Fighter) Group Filter Room became operational at Drumossie Hotel, having moved from Kirkwall during the night of 21/22 October (HRA, RDF Bulletin, October/ November 1941).

In November 1940 a Type 1 meteorological office with a Senior Meteorological Officer and forecasters providing a 24-hour forecasting service

67 Raigmore on 9 May 1942, with the protected accommodation for the Fighter Group Headquarters still under construction. With reference to the site plan below, the Operations Block can be seen in the trees upper centre, the Filter Block in the trees upper right and the Signals Block in the trees bottom centre (© Historic Environment Scotland).



68 Inverness (Raigmore) Fighter Group Headquarters site plan (© Crown Copyright Royal Air Force Museum).

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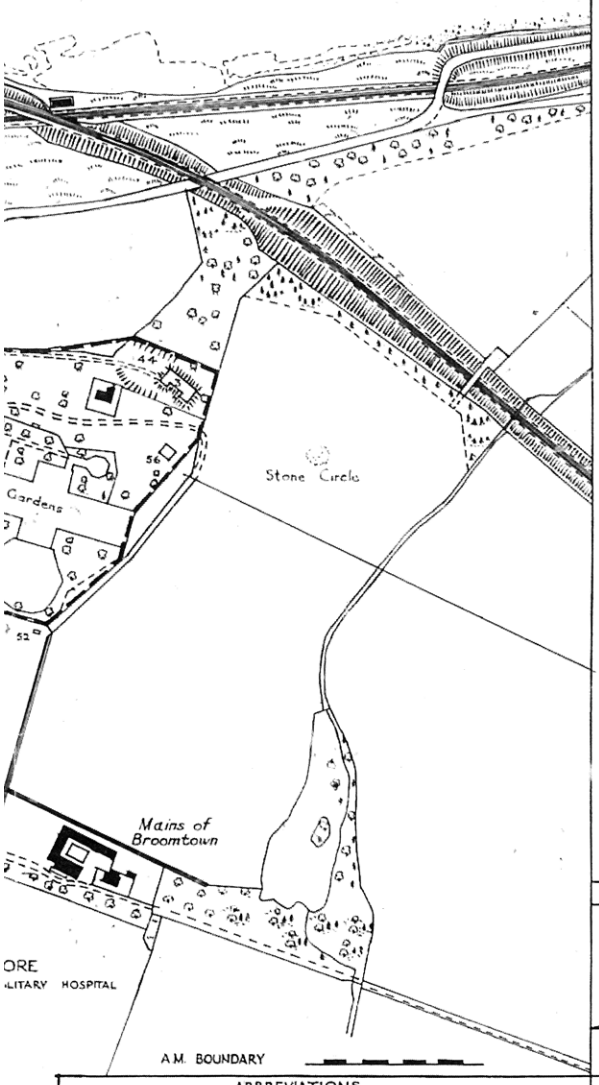


SCHEDULE OF BUILDINGS

BLDG Nº	BUILDING	CONSTR.	DRG. Nº
1.	OPERATIONS BLOCK	P.C.	6877/41
2.	FILTER	"	4820/41
3.	SIGNALS	"	3945/41
4.	TEMPORARY FILTER BLOCK.	S.F.G.T.B.	F.C.W. 4580
5	STAND-BY SET HOUSE. (2/250 K.W.)	N°1 P.B.	7523/41, 6459/41
6.	" " " " (" ")	N°2 "	" "
7	FIRE SECTION (18'6" × 19'-6")	T.B.	—
8.	STAND-BY SET HOUSE (3/45 K.W.) (NUMA SET)	P.B.	16444/40
9.	GUARD ROOM.	N	10024/41
10.	A.M.W.D. OFFICE (22'10" × 16'6")	T	WA15/914/41
11.	" STORE (13'0" × 10'0")	"	—
12.	SOLID FUEL COMPOUND (31'0" × 22'0").	T.B.	—
13.	RAIGMORE HOUSE. OFFICERS' MESS		REGD. PROPY.
14	OFFICERS' QUARTERS. (36'0" × 16'0")	N	WA15/914/41
15.	" " " (" ")	"	"
16.	" " " (" ")	"	"
17	" " " (" ")	"	"
18.	" " " (" ")	"	"
19.	" " " (" ")	"	"
20.	" " " (" ")	"	"
21	" " " (" ")	"	"
22.	" " " (" ")	"	"
23	" " " (" ")	"	"
24.	" " " (" ")	"	"
25	" " " (" ")	"	"
26.	" LATRINES, ABLUTIONS & BATHS.	T.B.	WA15/893A/41
27.	BATMENS' " & "	N	WA15/914/41
28.	" QUARTERS.	"	"
29	BARRACK HUT, AIRUEN.	T	WA15/402/42
30.	" " "	"	"
31.	" " "	"	"
32.	ABLUTION & LATRINE BLOCK.	"	"
33.	INSTITUTE.	"	"
34.	DINING ROOM, AIRUEN.	"	"
35	KITCHEN, COOK-HOUSE, ETC.	"	"
36.	BARRACK HUT, W.A.A.F.	"	"
37.	" " , N.C.O.S'.	"	"
38.	" " "	N	10024/41
39.	FUEL COMPOUND	T.B.	WA15/402/42
40.	INCINERATOR.	"	"
41.	GUARD HUT (10'6" × 10'6").	T	—
42.	"	"	—
43	CYCLE SHELTER (40'0" × 7'6")	"	—
44	LATRINE BLOCK I.U. L.C.C. (8'0" × 6'0")	T.B.	—
45.	G.P.O. B.O.X. (10'0" × 9'0")	P.B.	
46.	" " (" ")	"	
47.	" " (" ")	"	
48.	INTAKE SWITCH HOUSE.	"	12070/41
49	ELECTRIC R.M. TRANSFORMER PLINTH	T.B.	—
50.	" " " "	"	—
51.	" " " "	"	—
52.	" " " "	"	—
53.	" " " "	"	—
54.	WATER TANK E.W.S. 20,000 GALLS	P.C.	EN/14.GR/1/42
55	" " " " "	"	"
56	" " " " "	"	"

NOTE

DOWN GRADED

THIS IS A SECRET DRAWING, UNDER NO CIRCUMSTANCES MUST IT BE REPRODUCED. IT IS NOT TO BE SEEN BY UNAUTHORISED PERSONS, MUST BE KEPT UNDER LOCK AND KEY WHEN NOT IN USE AND ITS SAFE CUSTODY IS THE RESPONSIBILITY OF THE PERSON TO WHOM IT IS ISSUED.

RESTRICTED

ABBREVIATIONS

PERMANENT	CONCRETE BUILDINGS	INDICATED	THUS	P.C.
"	BRICK "	"	"	P.B.
TEMPORARY	"	"	"	T.B.
STEEL FRAMED	"	"	"	S.F.
NISSEN HUTTING	"	"	"	N.
TIMBER	"	"	"	T.

BASED ON Nº 15 WORKS AREA DRAWING Nº WA15/17C/45

INVERNESS (RAIGMORE)

RECORD SITE PLAN

ALL SITES

AMENDMENTS

SCALE : 1/2500

P.J. Lucken FOR W.B.	FOR D.G.W.	~~SECRET~~	D. G. of W.
P.S.W.			REGD. NO. 642/46
M.H.LIATHIS	JANUARY 1946	~~NUMBER~~	AIR MINISTRY

29½ × 21" 4

was formed at No 14 Group HQ. The responsibilities of the office included supplying Type 4 meteorological offices at Operational Training Units of Bomber and Coastal Commands in north-east Scotland (a Type 4 meteorological office consisted mainly of Interpreters, who were junior staff making weather observations without any forecasting officers) (Air Ministry, 1954: 71).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Group area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 5 GOR, a Class 'A' Type 1 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries.

A board, comprised of Squadron Leader Porteous, Flight Lieutenant Dickens, Flight Lieutenant Biggs and the Clerk of Works, Mr Kniverton, was appointed to take over the newly constructed buildings at Raigmore. They assembled in the Clerk of Works Office at Raigmore at 2.30pm on 25 January 1943. Also present were Flight Lieutenant Boswell and Sergeant Dixon in order to consider fire risks (TNA, AIR 25/253). At 11.59pm on 28 February 1943 Drumossie Operations Room closed and operations commenced at 12am on 1 March 1943 from Raigmore Operations Room (TNA, AIR 25/250).

The Unit Routine Orders for No 14 Group dated 24 April 1943 noted that several cases had been reported of dangerous riding by cyclists down Raigmore Hill to the main entrance. A warning was issued that if further cases were reported, riding down the hill would be prohibited (TNA, AIR 25/253).

The new Filter Block at Raigmore came into operation at 12.01am on 12 May 1943, the change-over from Drumossie taking exactly two minutes (HRA, No 14 Group RDF Bulletin, June 1943).

On 7 June 1943 a party of staff officers from Headquarters No 13 Group visited No 14 Group to discuss details regarding the amalgamation of Nos 13 and 14 Groups. They returned to No 13 Group HQ the same day. At 08.30 hours on 15 June 1943 Turnhouse Sector commenced operating under No 14 Group. At 08.00 hours on 15 July 1943 amalgamation of Nos 13 and 14 Groups took effect (TNA, AIR 25/250). On 20 April 1943, prior to the amalgamation, Air Vice-Marshal M Henderson, Air Officer Commanding No 13 Group made a case to Headquarters Fighter Command for the merged group to be designated No 13 Group:

> *I have to request that, on the amalgamation of Nos 13 and 14 Groups, the new Group shall be known as No 13 Group.*
>
> *No 13 Group was in existence before the outbreak of war and No 14 Group was formed from the Northern Sectors of No 13 Group at a much later date. The amalgamation of the two Groups is, therefore, to all intents and purposes, a return to the original organisation of No 13 Group and I consider, therefore, that the name of the older Group should be perpetuated.*

A minor, but also somewhat important, point is that if this suggestion is adopted the score board of No 13 Group of 164 enemy aircraft destroyed and 57 enemy aircraft probably destroyed would remain with the new Group.

There are also administrative advantages to the suggestion, in that the non-public funds of No 13 Group could be transferred complete to Inverness (TNA, AIR 16/675).

Alison Catto (Manson) served at Raigmore as a Filter Room Plotter from November 1942 until July 1944:

I was billeted at the Royal Hotel, Inverness … We marched on and off duty in good weather, otherwise by transport.

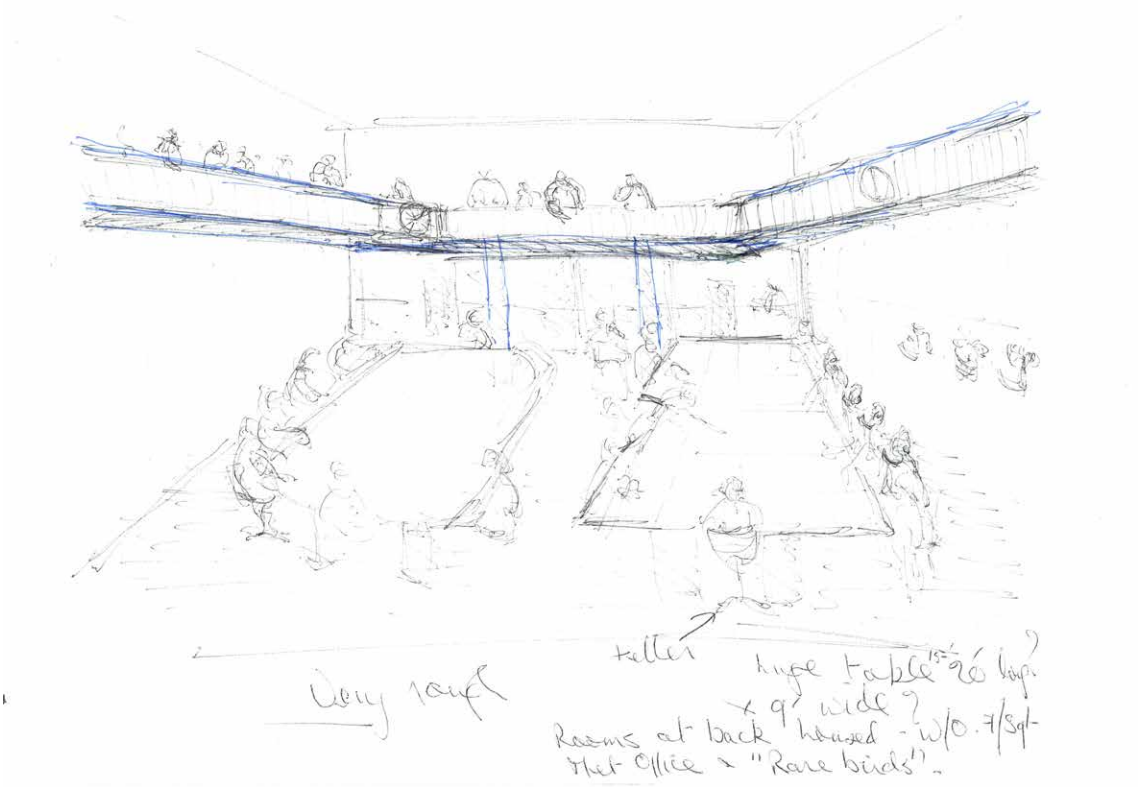
We tracked aircraft over land and sea by CH and CHL radar stations, comparing responses given by these stations – distance, height, direction, average speed, number of aircraft and whether friend or foe. We were supervised and watched by the RAF officers upstairs. When not busy we spoke to the boys who manned those stations – even made dates with them and met them later. We wrote letters, did knitting, sewing. Duties were to keep our Rest Room clean and tidy. Floors swept with wet, used tea covers to keep dust down. During a watch period we had so long off duty for tea/coffee break.

Otherwise, when not on duty, explored Inverness by walking, cycling, by ferry to islands. Coffee shops [were] *very friendly. Hotels organised dances by gramophone. Cinema. Hitch-hiking locally and further afield by lorry, van, car & felt safe* (Alison Catto, pers comm).

Another of the plotters at Inverness was Joy Moore (Wallden), who was a Clerk SD (Special Duties) there in 1944. She recalls,

plotting could be one or two radar stations at the same time, and usually different each watch … There were RAF and WAAF plotters – I think one or two relieving. Plotters on the table would say, "Inverness changing over," and the relief would plug in her headset to your socket on the table and say, "Inverness changed over." I think the breaks were about twenty minutes; there was a small rest room with a tea/coffee bar and buns. On our watch it was always the same RAF bod who served in there, but on other watches it varied.

Numbers on watch – cannot be absolutely certain but I think about twenty plus. There were plotters on the radar table, the observer corps table plus four-six in the balcony (MLS – FC etc.) [Movement Liaison Section, keeping track of friendly aircraft movements, Fighter Command and others] *plus two or three*



69 Sketch of Inverness Filter Room by Joy Moore, as it looked in 1944 when she served there (© Mrs Joy Moore).

> *relieving … I think two* [filter officers were on duty each watch] *on the table, but not necessarily at one time. We sometimes saw the same officers on watch … we didn't get to know them well …*
>
> [There was little hostile activity at that time, but it included] *regular German met flight off the coast of Norway. Attacks on Scapa? No, only panic when I plotted in the wrong square once!* [We plotted] *anything that flew – sometimes flocks of birds until the radar stations realised what the blips were … I also worked in MLS. Airfields rang up with estimated time of departure, number of aircraft, height and estimated time of arrival. Aircraft also showed IFF.*
>
> [During quiet periods] *wrote letters - read - knitted - especially on night duty … We were relieved on a regular basis - once or twice during a watch* (Joy Moore, pers comm).

On 7 April 1944 No 13 Group Operations Room closed down, operational control passing to the Fighter Sectors within the Group (TNA, AIR 25/234), which at that time were Turnhouse, Peterhead, Stornoway, Kirkwall and Lerwick.

Headquarters Fighter Command instructed on 17 May 1945 that the raid reporting (excluding ROC, which had already stood down) and control system in 13 Group area was to remain operating on a 24-hour basis (TNA, AIR 16/915). The stand down of the raid reporting and control system within No 13 Group was to take place on 16 June 1945, but due to unavoidable delays in the movement of certain fighter squadrons, this was postponed (TNA, AIR 20/2879) and stand down finally took place on 23 June 1945 (TNA, AIR 28/862).

Although the operations for the Group had moved from Drumossie Hotel during the spring of 1943, the administration staff of the Group HQ had remained there. However, during the course of 5-6 December 1945 Headquarters No 13 (Fighter) Group moved from Drumossie to the Station Headquarters at RAF Dalcross. This allowed the civilian billets occupied by HQ staff to be de-requisitioned, with all the staff accommodated at RAF Dalcross (TNA, AIR 25/234).

On 15 March 1946 Raigmore Filter Room closed down. The Movement Liaison Section and Flying Control Section continued to operate on a 24-hour-a-day basis. All supernumerary filter officers (additional to the regular staff) were posted away from No 13 Group on 19 March (TNA AIR 25/234).

Inverness

Unit	Observer Centre
Region	Highland
NGR	NH 6660 4529 (Stockroom, Caledonian Hotel, Church Street, Inverness)
NMRS	NH64NE 157
In use	2 October 1940 – 12 May 1945

Unit	Emergency Centre
Region	Highland
NGR	NH 6656 4550 (Old High Church Hall, 65-69 Academy Street, Inverness)
NMRS	NH64NE 779

On 22 July 1937 the Home Defence Committee recommended the adoption of certain proposals, including the formation of No 39 Observer Group covering the Moray Firth area including Inverness. One week later, the Committee for Imperial Defence ruled that the necessity for establishing No 39 Group was to be reviewed 12 months later. This was done by the Air Ministry and Home Office in August 1938, who noted that Inverness lay out of the range of bomber aircraft then in service with the German Air Force, a situation which would not be materially altered even if German bombers were able to operate from airfields in the Low Countries. This, combined with the fact that there were no vital points in the area that were considered worthwhile bombing targets, meant that it was concluded there would be no reason for German bombers to operate in the area. It was therefore considered that the formation of No 39 Group was unnecessary so long

70 Targe, awarded monthly between November 1941 and May 1944 to the best Post in No 39 Group (museum number EF.2013.36 © Trustees of National Museums Scotland).

as Inverness remained beyond the range of German bombers. It was recognised that an increase in the range of German bombers would enable them to outflank the Observer Corps organisation and attack the Forth-Clyde area from the North. It was considered that in those circumstances, the formation of No 39 Group would be desirable (TNA, AIR 2/1772).

Air Vice-Marshal Richard Peirse, Deputy Chief of the Air Staff, and Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command, both agreed with the decision not to proceed with the formation of No 39 Group at that time, with Dowding noting on 12 August 1938 that it might never be needed and that it was quite likely that inland radar would take over the function of the proposed Group. Even as late as 9 November, the Home Office Air Raid Precautions Department agreed (TNA, AIR 2/1772).

However, on 3 June 1940 Dowding wrote:

> *I consider immediate steps are required to expand the Observer Corps organisation to keep pace with the expansion of the Home Defence Organisation. The Observer Corps system must be extended to provide the defences with air intelligence … in Scotland, where I consider that a coastal fringe of observers is needed as far as Cape Wrath, with additional observer posts where practicable … I have therefore given instructions to the Commandant, Observer Corps to take immediate action to meet these requirements. This action will have the following results: the formation of an Observer Group with Centre at Inverness – to be called No 39 Group* (TNA, AIR 16/50).

Following this, No 39 Observer Group became operational on 2 October 1940 (TNA, AIR 16/50). Selection of sites for Observer Posts had already begun in July 1940 (TNA, AIR 2/20147, AIR 2/20155, AIR 2/20156) and August 1940 (TNA, AIR 2/20141, AIR 2/20142, AIR 2/20143, AIR 2/20146, AIR 2/20152, AIR 2/20153, AIR 2/20154). In the case of Tain Post, for example, the site was visited on 16 July 1940 and a reply received from AW Gray, Tain Town Clerk, on 2 August giving permission to proceed. Authority was given on 3 September to erect a hut and shelter (TNA, AIR 2/20143), with the Post presumably operational on 2 October.

The Observer Posts in No 39 Group were as follows:

A.1	Findhorn	NJ 038 649 (Oct 1940 – Oct 1941)
A.1	Nairn	NH 898 568 (Oct 1940 – May 1945)
A.2	Glenferness	NH 953 455 (17 July 1941 – May 1945)
A.3	Cawdor	NH 850 508 (Oct 1940 – May 1945)
B.1	Elgin	NJ 214 641 (Oct 1940 – Jan 1942)
B.1	Elgin	NJ 2125 6404 (Jan 1942 – May 1945)
B.2	Carron	NJ 229 439 (Oct 1940 – May 1945)
B.3	Dallas	NJ 133 525 (Oct 1940 – May 1945)
B.4	Findhorn	NJ 038 649 (Oct 1941 – May 1945)
C.1	Grantown on Spey	NJ 022 259 (Oct 1940 – May 1945)
C.2	Kingussie	NH 786 016 (Oct 1940 – May 1945)
C.3	Dalwhinnie	NH 639 863 (Oct 1940 – May 1945)
C.4	Farr	NH 687 340 (Oct 1940 – May 1945)
D.1	Drumnadrochit	NH 509 261 (Oct 1940 – May 1945)
D.2	Whitebridge	NH 491 155 (Oct 1940 – May 1945)
D.3	Fort Augustus	NH 382 096 (Oct 1940 – May 1945)
E.1	Inverness	NH 666 451 (Oct 1940 – May 1945)
E.2	Cannich	NH 342 315 (Oct 1940 – May 1945)
E.3	Beauly	NH 519 472 (Oct 1940 – May 1945)

F.1	Cromarty	NH 806 669 (Oct 1940 – May 1945)
F.2	Fortrose	NH 741 563 (Oct 1940 – May 1945)
F.3	Dingwall	NH 5492 5842 (Oct 1940 – May 1945)
F.4	Alness	NH 664 681 (Oct 1940 – May 1945)
G.1	Brora	NC 909 040 (Oct 1940 – May 1945)
G.2	Dornoch	NH 803 883 (Oct 1940 – May 1945)
G.3	Ardgay	NH 593 903 (Oct 1940 – May 1945)
H.1	Tain	NH 790 827 (Oct 1940 – May 1945)
H.2	Balintore	NH 863 759 (Oct 1940 – May 1945)
J.1	Bettyhill	NC 702 618 (May 1941 – Dec 1941)
J.1	Bettyhill	NC 700 627 (Dec 1941 – May 1945)
J.2	Melvich	NC 875 654 (Oct 1941 – May 1945)
J.3	Thurso	ND 096 713 (Oct 1941 – May 1945)
J.4	Duncansby Head	ND 406 733 (12 Oct 1941 – May 1945)
K.1	Watten	ND 246 540 (Dec 1941 – May 1945)
K.2	Wick	ND 375 499 (Oct 1941 – May 1945)
K.3	Latheronwheel	ND 181 315 (Oct 1941 – May 1945)
K.4	Berridale	ND 124 238 (Oct 1941 – May 1945)
L.1	Strathmore Lodge (WOU)	ND 102 479 (approx)
L.2	Kinbrace (WOU)	NC 855 316 (approx)
L.3	Langdale Lodge (WOU)	NC 696 448 (approx)
L.4	Forsinard (WOU)	NC 892 436 (approx)
M.1	Rispond (WOU)	NC 452 656 (approx)
M.2	Tongue (WOU)	NC 581 567 (approx)
M.3	Green Table (WOU)	NC 5216 2464
M.4	Lairg (WOU)	NC 583 073 (approx)
M.5	Overscaig (WOU)	NC 417 232 (approx)
N.1	Oldshore (WOU)	NC 209 581 (approx)
N.2	Elphin (WOU)	NC 216 114 (approx)
N.3	Scourie (WOU)	NC 146 444 (approx)
N.4	Culkein (WOU)	NC 018 346 (approx)
O.1	Reiff (WOU)	NB 967 159 (approx)
O.2	Braemore (WOU)	NH 200 792 (approx)
O.3	Melvaig (WOU)	NG 751 831 (approx)
O.4	Opinan (WOU)	NG 8787 9724

(TNA, AIR 2/19736, AIR 2/20097, AIR 2/20098, AIR 2/20099, AIR 2/20110, AIR 2/20111, AIR 2/20130, AIR 2/20132, AIR 2/20134, AIR 2/20135,

AIR 2/20136, AIR 2/20141, AIR 2/20142, AIR 2/20143, AIR 2/20144, AIR 2/20146, AIR 2/20147, AIR 2/20152, AIR 2/20153, AIR 2/20154, AIR 2/20155, AIR 2/20156, AIR 2/20157, AIR 2/20158; ROC Museum, WOU reporting to Inverness Centre; Wood, 1992: 326, 328-329, 331, 333).

Due to a shortage of men for Observer Corps posts in the North-West Highlands, No 18 Wireless Observer Unit (also known as No 18 Wireless Unit) comprising RAF personnel was used to perform a similar role, sending reports of aircraft movements to their HQ at RAF Tain for onward transmission to Inverness Observer Centre (TNA, AIR 25/250; ROC Museum, WOU reporting to Inverness Centre; Hughes, 1998: 93).

On 9 April 1942 Post D.1 at Drumnadrochit reported a Monster at grid reference QJ 0549 (in Loch Ness, about 1½ miles due east of the Observer Post) to Inverness Observer Centre. It was reported as travelling north-east at a height of one minus (ie below 1,000 feet). Believing the report to be genuine, this was accepted by Inverness Centre as a Miles Master advanced trainer aircraft and passed to Inverness Filter Room where it was designated a Learner (ie a training aircraft). The original report was clearly intended as a joke but by accident, possibly due to a poor telephone connection, it had been taken seriously by Inverness Centre (HRA, No 60 Group RDF Bulletin, April 1942).

The Controller at Inverness was Douglas H Hunter (TNA, AIR 2/20098) and the Observer Group Officer was JOA Fraser-Mackenzie until 1943. In 1943 the new position of Group Commandant was created and that of Observer Group Officer was deleted. Observer Commander John OA Fraser-Mackenzie became the Group Commandant for No 39 Group in 1943 and remained so until 1945 (Wood, 1992: 272), receiving the MBE in September 1944 for his service in the ROC (*The Oban Times*, 30 September 1944).

No 39 Group, along with Nos 36 (Dunfermline), 37 (Dundee) and 38 (Aberdeen) Groups, was involved in a particularly efficient performance on the night of 9/10 June 1943. Four Vickers Wellingtons and two Armstrong Whitworth Whitleys from Lossiemouth and Kinloss airfields were on a night cross-country exercise when their airfields became fog-bound. Three of the Wellingtons were ordered to make for Banff and landed at 1.11am, 3.18am and 4.07am before that airfield was fog-bound. A Whitley was sent to Wick and landed there at 4.18am. The other Whitley was sent to Leuchars, landing safely there at 4.27am. The last Wellington was sent from Lossiemouth to Peterhead, which it was unable to find due to the weather, and then re-directed to Dyce. It was unable to land at Dyce as it was by then fog-bound and thus the Wellington was then sent to Leuchars, where it safely landed at 5.20am. With one exception, all six aircraft were tracked exclusively by the Royal Observer Corps, a remarkable feat considering the weather conditions (Winslow, 1948: 188-189).

Inverness Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Johnstone

Unit	Sub-Gun Operations Room
Region	Renfrewshire
NGR	NS 4190 6429 (Merchiston House)
NMRS	NS46SW 237
In use	circa 1942 – 5 February 1943

Johnstone was 'E' Sub-GOR of the Clyde GOR at Aikenhead House, and was located at Merchiston House (TNA, WO 166/7399). The house was owned and occupied by Charles K Finlayson, a thread manufacturer (Valuation Rolls, Merchiston House, 1939-40 and 1940-41).

At 12pm on 2 February 1943 Lieutenant Colonel Sir JA Ruggles-Brise was replaced as AADC at 'E' Sub-GOR by Lieutenant Colonel GH Philip. However, this appointment was only for three days, because at 9am on 5 February 1943 'E' Sub-GOR closed down (TNA, WO 166/11216).

Kinloss

Unit	Gun Operations Room
Region	Moray
NGR	NJ 0540 6391 (K1 Command Post)
NMRS	NJ06SE 92
In use	June 1940 – circa 1943

Orders were issued to 3rd Anti-Aircraft Division on 21 April 1940 for AA protection of Kinloss and Lossiemouth airfields with two 2-gun emplacements at each. 297 AA Battery with four 3.7-inch mobile guns moved to Kinloss on 28 or 29 June 1940 (TNA, WO 166/2128).

The Battery, designated K1, was located to the north of the airfield (TNA, WO 166/2128) and, since it was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room at Kinloss (TNA, WO 166/2129) it is assumed this was in the Battery Command Post.

508 Gun Operations Room was a Class 'C' GOR at Kinloss. It was operating there on 14 May 1942 (TNA, WO 212/81) and 1 October 1942 (TNA, WO 212/82). The telephone line to Kinloss GCC was put temporarily out of service on 18 August 1942 and the main warning line to No 14 (Fighter) Group HQ at Inverness switched to the LAA Troop HQ (TNA, WO 166/7371).

Kirkwall

Unit	FSHQ, Filter Room and Gun Operations Room
Region	Orkney Islands
NGR	HY 4540 0996 (Bignold Park)
NMRS	HY40NE 41.01
In use	23 February 1940 (GOR), 25 September 1940 (Filter Room), 16 October 1940 (FSHQ) – 22 October 1941

Unit	FSHQ, Sub-Filter Room and Gun Operations Room
Region	Orkney
NGR	HY 4540 0996 (Bignold Park)
NMRS	HY40NE 41.01
In use	22 October 1941 – 29 January 1944

Unit	FSHQ, Sub-Filter Room and Gun Operations Room
Region	Orkney
NGR	HY 4604 0970 (Kirkwall Kremlin/Black Building)
NMRS	HY40NE 28
In use	29 January 1944 –20 May 1945 (GOR), 25 July 1945 (SFR), 23 March 1946 (FSHQ)

RAF Bignold Park at Kirkwall was brought up to full strength as a detachment from RAF Wick and opened an Operations Room on 7 November 1939 (TNA, AIR 28/915). The main FSHQ opened at Wick on 19 February 1940 (TNA, AIR 28/917), remaining there until 4.20pm on 16 October 1940, when Wick Sector was replaced by Kirkwall Sector (TNA, AIR 25/250). Prior to this, Kirkwall Filter Room had opened on 25 September 1940, taking over from Wick Filter Room (TNA, AIR 24/507)

Kirkwall FSHQ and Filter Room were housed in an adapted wooden aircraft hangar on the southern outskirts of the town (HRA, Radar Bulletin, January 1944; Stell, 11; Dr BG Morgan, pers comm). This is believed to have been the Allied Airways hangar from Howe (Stromness) Airfield (Cyril Parkes, pers comm) which certainly was a wooden hangar and was dismantled and moved after the airfield was requisitioned by the Air Ministry (Clegg, 2012: 30). The accommodation was shared with 332 Gun Operations Room, a Class 'B' GOR, which began operating on the site on 23 February 1940 (TNA, WO 166/1234, WO 212/81; Hewison, 1990: 340). Included in the Sector Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 205 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries.

Although based within Kirkwall FSHQ, the Filter Room operated as No 14 Group Filter Room until 21/22 October 1941 when it closed down and moved to Inverness (HRA, RDF Bulletin, October/November 1941).

On 4 November 1941 the Watch Establishment for the Sector Operations Room at Kirkwall was set by Headquarters Fighter Command as:

Supervisor	1 Sergeant
Deputy Controllers	2 Sergeants
Ops A	1 Aircraftman
Ops B1	1 Aircraftman
Ops B2	1 Aircraftman

Bomber Plotters	2 Aircraftmen
Fighter Plotters	2 Aircraftmen
D/R Plotters	2 Aircraftmen
Triangulator Teller	1 Corporal
Triangulator Setters	3 Aircraftmen
RDF Plotters	2 Aircraftmen (plotting positions from HQ 14 Group and Lerwick)
CHL Plotters	3 Aircraftmen (Fair Isle, Deerness/Crustan, South Ronaldsay/Dunnet Head)
GCI Plotter	1 Aircraftman (Northtown)
GCI Liaison	1 Corporal
Map Tracer	1 Aircraftman
Messengers	2 Aircraftmen (Aircraft Hands)
Emergency Filterer	1 Sergeant
MLO's Clerk	1 Corporal
NCO in charge	1 Flight Sergeant
NCO Assistant	1 Sergeant
Tracer	1 Corporal
Clerk General Duties	1 Aircraftman (TNA, AIR 2/3546).

Due to a shortage of men for Observer Corps posts in the North and North-West Highlands, No 18 Wireless Observer Unit (also known as No 18 Wireless Unit) comprising RAF personnel was used to perform a similar role. Several posts of No 18 Wireless Observer Unit were established in Orkney, reporting to Kirkwall FSHQ, as follows:

E.1	Air Observer Post	Aikerness, Westray
E.2	Air Observer Post	Hollandstoun, North Ronaldsay
E.3	Listed as not used, but presumed to be allocated to Post in Sanday	
E.4	Air Observer Post	Cleat, Stronsay
E.5	Air Observer Post	Twee Ber, Deerness
E.6	Air Observer Post	Black Braes, West Mainland
E.7	Air Observer Post	Grim Ness, South Ronaldsay (TNA, AIR 16/915)

Two posts, Westray and Sanday, became operational during November 1942 (TNA, AIR 28/917). On 30 June 1945 there were two persons left at each of these posts and they were ordered to report from 9am until 5pm every weekday (TNA, AIR 16/915).

Jeanne Williams (Oxley) recalled her posting to Kirkwall:

In May 1943 I was posted as Cpl i/c with eleven others Clerk Special Duties (Fighter Plotter) to Kirkwall. We were the first airwomen at the camp which was situated on both sides of the Holm Road … The domestic site was on one side of the road and on the other were the Admin Offices, the Officers' Mess

and the Operations Block. The WAAF site was alongside the RAF quarters but divided by a swamp and masses of barbed wire! It was a brand new site of Nissen and wooden huts, completely self contained, comprising sleeping and recreational quarters, guard room, NAAFI, sick quarters, hairdressers, etc, and far superior to that which many of us had experienced; here the ablution huts were attached to the sleeping huts and that was five star living! (Williams (1), 8).

The temporary Operations Room … was typical of the early period. The Ops Table was in the centre with the Plotters around it. On a raised dias facing the centre sat the Controller and his assistants and on the opposite wall was a large board giving all the information of the readiness of the RAF squadrons in that area. On each side were the desks of the Navy and Ack-Ack officers and at a smaller table sat the D/F Plotters. The whole appearance was of DIY but very efficient nevertheless.

The Fighter Sector purpose-built Operations Block at the top of Inganess Road became operational on 29 January 1944. Everything was far more technical and far more spacious but no more efficient. The Controller and other officers were behind glass high above the Ops Room and there were offices for Navy, Army, Signals, etc. The Ops Room plotted <u>all</u> aircraft, day and night, but only <u>controlled</u> RAF squadrons …

The Operations Room was in the centre of the building and there were many other departments housed in the Block. Signal Section had a large area for its wireless, teleprinter and telephone operators. The Navy and Army had their own 'Ops' Room and offices. Intelligence and Meteorological Sections also had offices, as well as various officers in command. There were Rest Rooms for Officers, RAF and WAAF and a canteen (which served tea and awful Camp essence coffee and 'wads'), except on night duty, when the Camp Cookhouse provided DIY cheese sandwiches. Of course there was a guard room, manned by members of the RAF Regiment, who were on duty at the two entries; one for officers and the other for Other Ranks and <u>NO ONE</u> gained entry without the appropriate pass.

In the Ops Room, on a large table map of the North of Scotland, Orkney Isles and Shetland, <u>all</u> aircraft were plotted, friendly and hostile, but the Controller was only responsible for directing aircraft of RAF squadrons. The Fleet Air Arm had their own Controller in a Control Room at Twatt, but they received information of enemy activities from the RAF Ops Room.

Personnel in the Ops Room were as follows:
- *Controller - a senior RAF officer*
- *Ops 'A' - an RAF officer (often under training for Controller) and in direct touch with the RAF squadrons*
- *Ops 'B' - usually a WAAF officer and in touch with Group HQ etc*
- *Two Deputy Controllers - RAF Sgts*

- *A RAF/WAAF Sgt - in charge of the Watch*
- *Approx 24 airmen/airwomen who manned the plotting positions on the main table and in the Filter Room and D/F (Direction Finding) Room*

The Plotting Table was in the well of the room with the Controller and his Assistants on a higher level in a glass cabin. Opposite the controller was a large 'Tote' Board which gave all the readiness information of the RAF squadrons. Also on this level and in glass-fronted offices were the Navy, Ack-Ack Liaison Officers and their staff. On the same floor as the Plotting Table were the Filter and D/F Rooms and office of the NCO i/c the watch. The Deputy Controllers were on a dias beneath the Controller. There were six manned positions on the Operations Table receiving plots from various filter rooms, ie Inverness, (2 lines), Sumburgh, Kirkwall, Peterhead and Tiree (Hebrides). There was also a 'Y' position, a very secret line, which received little information but had to be manned 24 hours a day [this was connected to the Y Service which intercepted enemy radio transmissions, and very likely to the HQ of the RAF Y Service at Cheadle in Staffordshire].

Personnel were divided into three watches: A, B & C and worked the following shifts:
Day 1: 0800 - 1230 hrs and 2000 - 2359 hrs
Day 2: 1230 - 1630 hrs
Day 3: 0001 - 0800 hrs and 1630 - 2000 hrs

Twice double watches were ordered, ie everyone on duty - that was when the new 'Ops' was opened and the old one had to be manned until the take-over was complete, and the run-up to D-Day. Plotters were changed frequently during a shift owing to the concentration needed but if flying was restricted because of bad weather etc, they were allowed to read and knit, but always wore headphones.

I vaguely remember a German aircraft being shot down over Scapa Flow but do remember talking down a lost aircraft and being unable to help another lost pilot. Night flying from Hatston was always a busy time for Plotters and I seem to remember a couple of aircraft ditching in Kirkwall Bay (Williams (2), 7-8).

We were issued with penguin suits, ie black oilskins and sou'westers - one size only - men's - so you can guess how well they fitted. We coped with all the weather thrown at us, frequently gale force winds, horizontal rain and blizzards. But then we had the long summer days when we visited the many beautiful sandy bays, swimming, paddling and sun bathing.

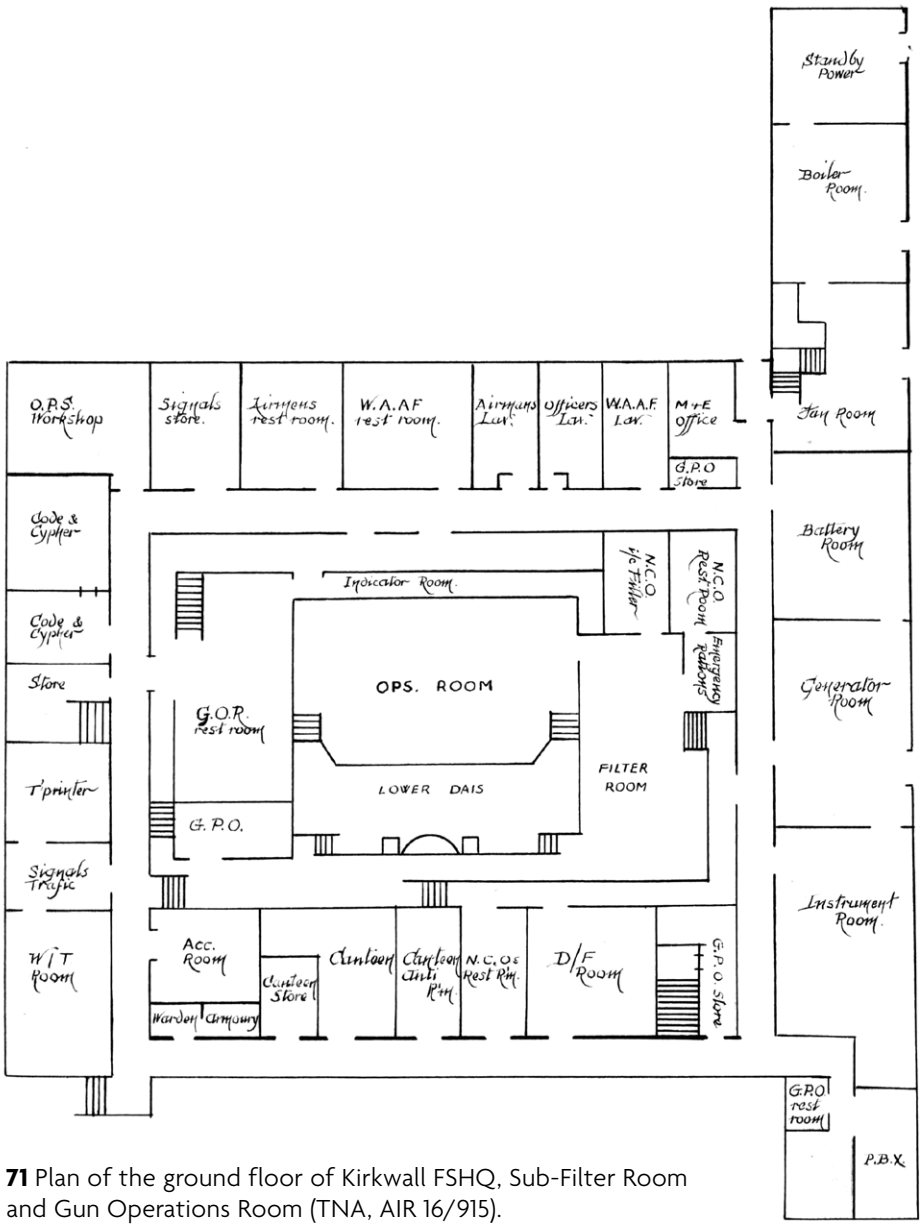
On the days we were on duty in the afternoons, we had drill, PT, hut or kit inspections from 8.30 until 11.30 hrs. With luck we were granted one watch off per week.

We worked very hard but we always enjoyed our free time to the full. We walked, hitch-hiked and cycled through the islands. One favourite spot was Waulkmill Bay where we could have tea in a little shed which was owned by two elderly ladies who provided us with boiled eggs, scones and homemade jam for one shilling. In the winter months we relied on the facilities in Kirkwall - the Church of Scotland Canteen, … Costies Café, the cinema and Drill Hall dances. Our social life could be quite hectic. There was usually a truck at the WAAF Guard Room each evening to take airwomen to a dance at one of the many Ack-Ack or searchlight sites. At weekends there was HM ship visiting in Scapa Flow and dances on Flotta. The US ships are remembered for their generosity with food. On camp there were films, ENSA shows, camp concerts, dances and plenty of sports and clubs. The Drama Club once produced a Passion Play in St Magnus Cathedral which was appreciated by civilian and service personnel. Vivid memories of those days include views over Scapa Bay when I opened my hut door, trying to keep warm on a bucket of coal per day, the kindness of the crofters when we went egg and butter collecting, whistling to the seals in Scapa Bay, tennis at Costies, morning coffee upstairs in Fletts Home Bakery and high teas and dinners at the Royal and West End Hotels on pay day! I remember especially how the people welcomed us; we must have been an intrusion on their life but they never showed it.

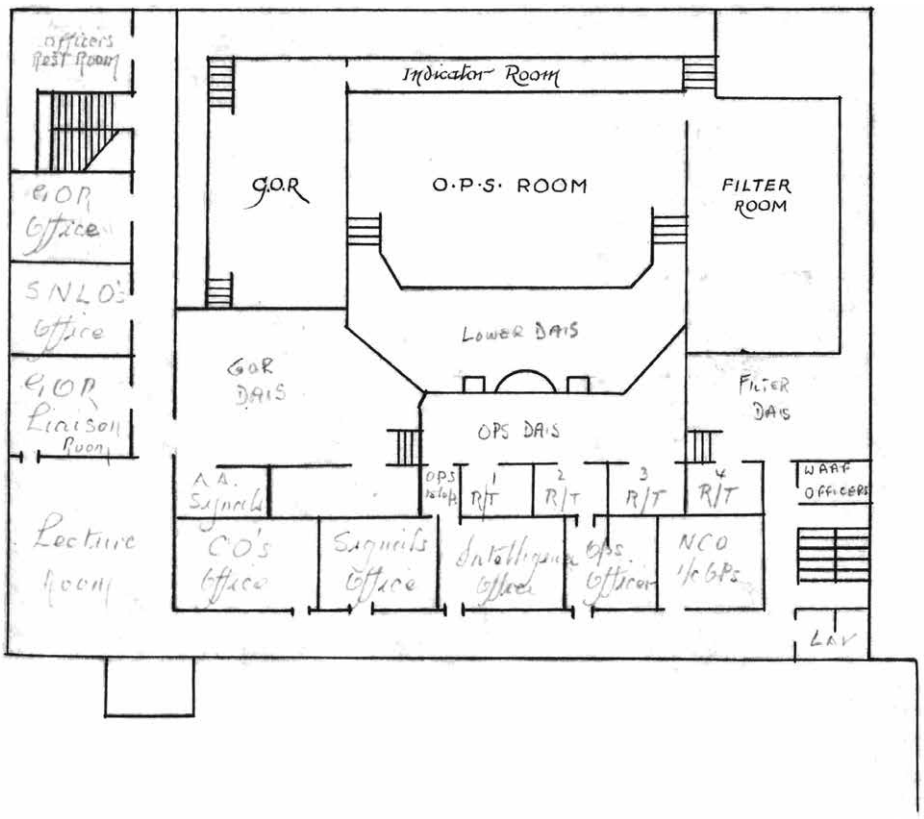
Our tour of duty was for nine months but I don't know of any WAAF in Ops who did not volunteer for a second tour, despite the fact that about 95% of the Ops WAAF came from the south of England. I was very upset when I left Orkney in February 1945 (Williams (1), 8-9).

On 29 January 1944 a purpose-built combined Sector Operations Room and Gun Operations Room opened in a protected building nearby, with the Sub-Filter Room housed in this new building (TNA, AIR 28/917). As part of the work of the SOR, radio transmissions between fighter pilots and the Controller were broadcast over loudspeakers within the Operations Room, and some insight into such messages was given in a letter on 25 February 1944:

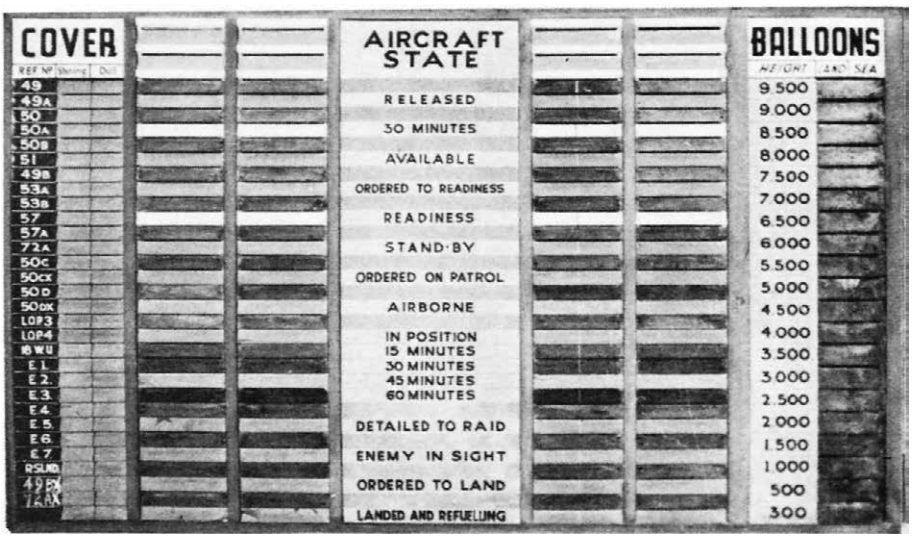
The Sector Signals Officer has asked me if I will bring to your notice the prevalence of the use of bad language over the R/T by some pilots of 132 Squadron. It is hoped that a gentle hint from you in the right direction will be sufficient to get the chaps concerned to pipe down a little, so as to avoid any necessity of drawing the Sector Commander's attention to the matter. He is particularly hot on anything of the sort. All R/T chatter is logged and some of it is not very nice reading! Apart from bad R/T discipline, and unnecessary prolonging of transmission there is also the question of ethics to consider. There are a number of WAAFs employed in the Operations Room and even if they are in uniform, they still remain women and are entitled to be spared unnecessary embarrassment.



71 Plan of the ground floor of Kirkwall FSHQ, Sub-Filter Room and Gun Operations Room (TNA, AIR 16/915).



72 Plan of the first floor of Kirkwall FSHQ, Sub-Filter Room and Gun Operations Room (TNA, AIR 16/915).



73 Tote Board from Kirkwall FSHQ Operations Room (Kirkwall Grammar School).

74 Scapa Gun Operations Room, housed within Kirkwall FSHQ, taken in June 1944 (© Imperial War Museum London H39420).

> *Please be assured that there is no intention at this end to cause friction. That is why the SSO* [Sector Signals Officer] *wants the matter dealt with out of court. It is merely requested that those concerned be asked to keep the language within reason and save the maidenly blushes of these carefully nurtured damsels. In the heat of battle, of course, anything is understandable. On training flights, however, there is really no necessity to blast the ether with oaths* (Findlay, 1975).

Scapa Gun Operations Room ceased to be operational on 20 May 1945 (TNA, AIR 28/917). At 12.00 hours on 25 July 1945 Kirkwall Sub-Filter Room closed down and all filter personnel were withdrawn (TNA, AIR 25/234), with radar stations plotting to Inverness Filter Room. The Movement Liaison Section at Kirkwall closed at the same time, with all aircraft movement information thereafter passed to MLS at Inverness. In the event of a major breakdown in communications between Orkney and the Scottish mainland Kirkwall Sub-Filter

Room would be manned as soon as possible by personnel from Inverness Filter Room (TNA, AIR 16/915).

On 1 November 1945 Fighter Sector Headquarters Kirkwall was redesignated Orkneys FSHQ. At 4.30pm on 15 March 1946 the FSHQ ceased controlling, and the Operations Room closed on 23 March with Flight Lieutenant GH Richards as the last Controller. The Operations Record Book noted that it had "controlled the interception and destruction of 24 hostile aircraft during the period it has been in use" (TNA, AIR 28/917).

Kyle of Lochalsh

Unit	Gun Operations Room
Region	Highland
NGR	NG 7565 2740 (B1 Command Post)
NMRS	NG72NE 46
In use	1940 – late-1943

Instructions were received by 3rd Anti-Aircraft Division on 13 January 1940 indicating that AA defence would be required for naval anchorages in the vicinity of Kyle of Lochalsh and Oban by April 1940. The General Officer Commanding 3rd AA Division attended a conference at the Admiralty on 18 January 1940 on the requirements for the combined services at Kyle of Lochalsh and Oban. A reconnaissance was carried out in both areas on 23 January 1940 by Lieutenant-Colonel R Rathbone, Major HA Hounsell and combined services staff (TNA, WO 166/2128).

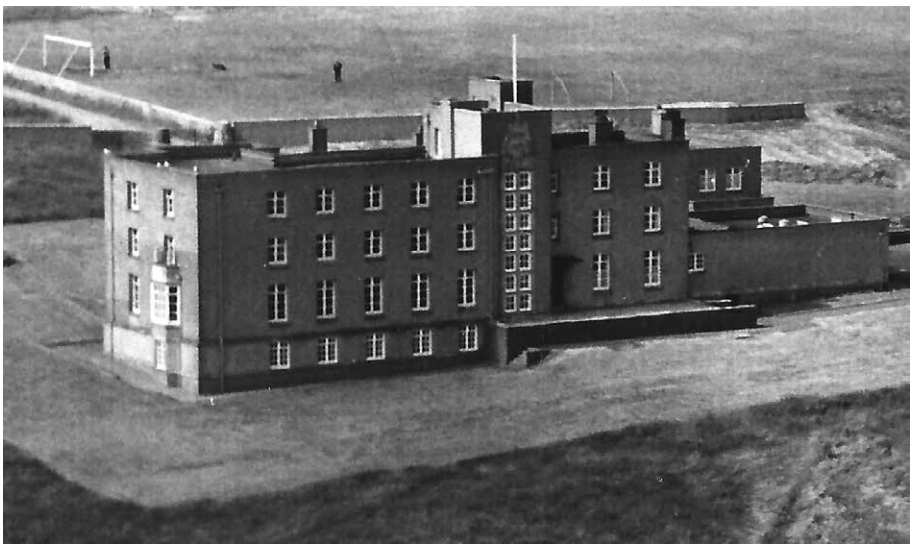
The Headquarters of 292 HAA Battery, 36 AA Brigade, were located at B1 gun emplacement (TNA, WO 166/2128) and, since it was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room at Kyle of Lochalsh (TNA, WO 166/2129) it is assumed this was in the Battery Command Post.

Oddly, the Gun Operations Room at Kyle of Lochalsh is not included in a list dated 1 October 1942 (TNA, WO 212/82) but is noted in a list dated 29 April 1943 (TNA, AIR 16/675). It probably closed in the second half of 1943. The HAA batteries in the Kyle of Lochalsh GDA were unarmed by 10 November 1943 (TNA, WO 166/11169) so the GOR would almost certainly have closed by that date.

Lerwick

Unit	FSHQ, Sub-Filter Room and Gun Operations Room
Region	Shetland Islands
NGR	HU 4807 4080 (Boy's Hostel)
NMRS	HU44SE 105
In use	1941 (GOR), 17 January 1942 (SFR) – 20 July 1945 (FSHQ), 5 August 1945 (SFR)

In 1938 work started on a boy's hostel, for male pupils from country and outer island locations attending the Anderson Educational Institute in Lerwick. This

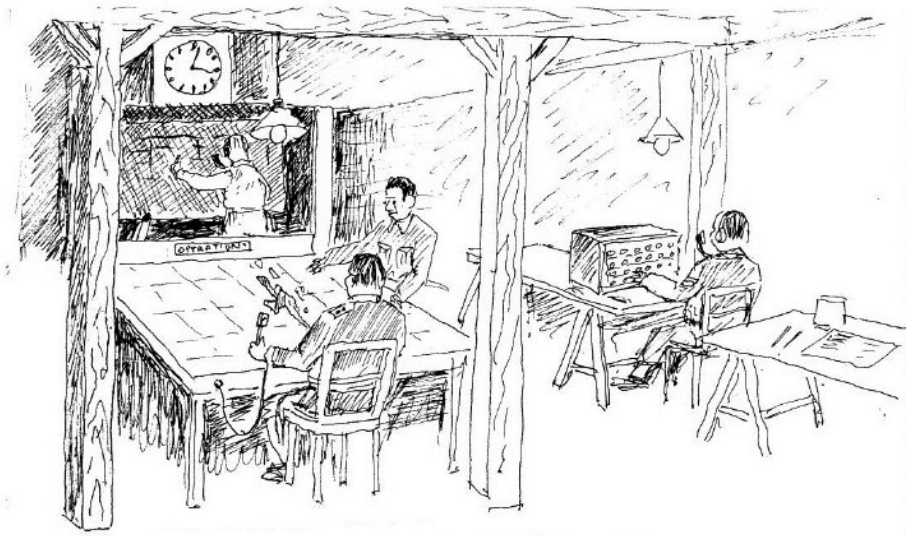


75 Boy's Hostel, Lerwick, used as Lerwick Fighter Sector Headquarters, Lerwick Sub-Filter Room and Shetland Gun Operations Room (© Dennis Coutts).

work was interrupted by the outbreak of war and the incomplete building was requisitioned. During the early part of the war, prior to its use for Shetlands Gun Operations Room (the incorrect but official name), the basement of the Boys Hostel was used as an air-raid shelter for AEI pupils (Sinclair, 2017: 27).

Mr EV Adcock was posted from Scapa GOR to help set up the Shetland Gun Operations Room, eventually designated 322 GOR and a Class 'B' GOR (TNA, WO 212/81).

> *On 10th December 1940 they put me aboard the* Atlantic Coast *to take me to Lerwick to start a GOR there, in what was known then as the new Boys Hostel. I was there for three years …*
>
> *The GOR occupied the room behind the five ground-floor windows … but we were protected by a sandbag wall which came as high as the projecting moulding … The building was unfinished, most walls being unplastered. The Ops Room was reinforced with timber supports. The entrance was at first-floor level, then down steps to a door with a peep-hole. That was bottom left of my rough sketch … A Thompson sub-machine gun hung on the timber support …*
>
> *It must have been some time in 1942 that the RAF established a filter room in the same building, on the first floor I think, and we had our information from them. They had a hot-water system installed as well, with proper wash-basins, but we 'brown jobs'* [Army personnel] *were not allowed to use them. We did though …*



76 Sketch of Shetland GOR in the ground floor of the Boys Hostel, Lerwick, 1941 (© EV Adcock).

> *When I was on watch one day, I took a call from the Coastguard or lighthouse keeper at Out Skerries. He told me that there were "three German flying-machines heading for Lerwick." We had no radar plots, but the Bressay guns were alerted and they shot down one of the three. The others made off, I think* (EV Adcock, pers comm).

An emergency filter room was opened at RAF Sumburgh on 29 January 1941 to deal with radar information from Shetland (HRA, RDF in Northern Scotland and the Islands). The Sub-Filter Room operated at Sumburgh until 17 January 1942, when it began operating from the Boys Hostel in Lerwick (TNA, AIR 26/100; Gordon Carle, pers comm).

On 4 November 1941 the Watch Establishment for Lerwick Sector Operations Room was set by Headquarters Fighter Command as:

Ops B	1 Corporal
Bomber Plotters	1 Aircraftman
D/R Plotters	1 Aircraftman
Tracer	1 Corporal (TNA, AIR 2/3546).

Lerwick Sub-Filter Room received plots from radar stations in the Shetland Islands, including Fair Isle (Brown, 2022: 23). Fair Isle radar stations noted during June 1942 that errors in ranges were due to delays in passing plots, due to the fact that the Lerwick phone line was not constantly manned at Lerwick. A fault in the phone ringing circuit at Lerwick was discovered, which much improved the matter. However, in July 1942 Fair Isle recorded that delays of up to two minutes

raising Lerwick Filter Room were experienced occasionally and it was submitted that these time delays would be avoided if the filter room could arrange continuous manning of the Fair Isle line (TNA, AIR 26/100).

Fair Isle also noted in September 1943 that difficulties were experienced on the plotting phone lines to Inverness and Lerwick Filter Rooms, due to the practice of coupling up the lines with other stations and also with the amount of chatter permitted between the plotters at the filter rooms and the other radar stations. The Officer Commanding at Fair Isle sent a complaint to No 70 (Signals) Wing, responsible for technical and administrative support to the radar stations, asking them to approach the filter rooms on this matter. The frustration experienced by Fair Isle staff in this matter is clear from the wording of the monthly report submitted by Lieutenant A Hodgkinson on 2 December 1942:

> *A recent interception was seriously spoiled by the appalling (and generally unnecessary) chatter which went on during plotting from the filter rooms. It cannot be too strongly stressed that unnecessary talking is both confusing and useless, leading to more inefficiency than clarity of plotting reports. Representations were made afterwards to both Lerwick & Inverness Filter Rooms with a view to improving the position. The position is aggravated by the Lerwick Filter Room coupling our lines in common with several Shetland stations, in spite of the fact that we already have two stations* [on Fair Isle] *and two filters and Kirkwall on the line* (TNA, ADM 166/4987).

On 19 February 1944 a Junkers Ju 88 flew over Scalloway and headed eastwards to Lerwick, where it was seen from the windows of both the FSHQ and Sub-Filter Room, flying at a height of 300 feet. It then flew over Bressay, turned north-east and was seen over Whalsay at 200 feet before heading east and gaining height. No hostile act was carried out and no interception was made of the aircraft (TNA, AIR 25/234; HRA, HQ 60 Group Radar Bulletin, February 1944).

A similar incident happened on 5 March 1944 when, at 6.06pm, a Junkers Ju 88 was seen flying past the Lerwick Sub-Filter Room windows at less than 1,000 feet. Shetland GOR had been warned, which allowed Bofors light anti-aircraft guns to engage the aircraft as it flew over Lerwick harbour. The Junkers was hit, and crashed into the sea just north of Bressay, three survivors being picked up by a high-speed launch (TNA, AIR 25/234; HRA, HQ 60 Group Radar Bulletin, March 1944).

The low-level flypasts by enemy aircraft were repeated on 2 April 1944 when another Junkers Ju 88 appeared outside the Sub-Filter Room without warning. It had flown in over Bressay and then turned north and flew out over Herma Ness on Unst without being intercepted (TNA, AIR 25/234; HRA, HQ 60 Group Radar Bulletin, April 1944).

On 20 July 1945 the Sector Operations Room closed down (TNA, AIR 25/234), and the Sub-Filter Room followed suit at 1pm on 5 August (TNA, AIR 16/915). The Boys Hostel was de-requisitioned in the autumn of 1945 and

building work restarted in spring 1946. It was opened in October 1947 and named the Janet Courtney Hostel (Sinclair, 2017: 27).

Loch Ewe

Unit	Gun Operations Room
Region	Highland
NGR	NG 8566 8060 (Poolewe)
NMRS	NG88SE 73.01
In use	1942 – 1943

336 Gun Operations Room was a Class 'B' GOR and opened in Poolewe circa 1942. It was operating there by 14 May 1942 (TNA, WO 212/81). The Regimental HQ of 113th Heavy Anti-Aircraft Regiment was established at Loch Ewe in August 1942, controlling gun sites at Fort William, Kyle of Lochalsh and Oban (TNA, WO 166/7481; WO 212/82).

At 10.30pm on 26 August 1942 eight ATS personnel proceeded to No 2 Company (Scotland) for duty at Loch Ewe GOR (TNA, WO 166/7371).

The GOR was still operating on 1 October 1942 (TNA, WO 212/82). The Loch Ewe Heavy Anti-Aircraft gun sites were all unarmed by November 1943 (TNA, WO 166/11169) and although the exact date is unknown it seems likely that the GOR closed in 1943 also.

Lossiemouth

Unit	Gun Operations Room
Region	Moray
NGR	NJ 1870 7068 (L2 Command Post)
NMRS	NJ17SE 10
In use	June 1940 – circa 1943

Orders were issued to 3rd Anti-Aircraft Division on 21 April 1940 for AA protection of Kinloss and Lossiemouth airfields with two 2-gun emplacements at each. 291 AA Battery with four 3.7-inch mobile guns moved to Lossiemouth on 27 June 1940 (TNA, WO 166/2128).

The Battery HQ was located at HAA gun emplacement L2 to the north of the airfield (TNA, WO 166/2128) and, since it was noted in 3rd AA Division Operational Instruction Number 5 dated 22 November 1940 that there was a 'Satellite' Gun Operations Room at Lossiemouth (TNA, WO 166/2129) it is assumed this was in the Battery Command Post.

507 Gun Operations Room was a Class 'C' GOR at Lossiemouth. It was operating there on 14 May 1942 (TNA, WO 212/81) and 1 October 1942 (TNA, WO 212/82). The telephone line to Lossiemouth GCC was put temporarily out of service on 18 August 1942 and the main warning line to No 14 (Fighter) Group HQ at Inverness switched to the LAA Troop HQ (TNA, WO 166/7371).

Newcastle

Unit	Fighter Group Operations Room
Region	Tyne and Wear
NGR	NZ 216 674 (Armoured Hut)
In use	24 July 1939 – 13 March 1940

Unit	Fighter Group Operations Block
Region	Tyne and Wear
NGR	NZ 2165 6738
In use	13 March 1940 – 15 July 1943

Unit	Fighter Group Filter Block
Region	Tyne and Wear
NGR	NZ 2121 6687 (Air Ministry Drawing No 4890/41)
In use	3 September 1941 – 1 July 1943

On 27 September 1938 the Air Ministry wrote to Newcastle Council requesting the purchase of land owned by the council in Blakelaw for offices. The council initially refused to allow the sale of the site, which had been allocated for the construction of housing for people displaced from slum clearances (Tyne and Wear Museum Archaeology Department, 2003: 8).

No 13 (Fighter) Group was formed on 24 July 1939 (TNA, AIR 25/232) with the Group Headquarters housed in temporary accommodation (Tyne and Wear Museum Archaeology Department, 2003: 5).

In September 1939 the Meteorological Section at No 13 Group HQ was raised to a Type 1 meteorological office with the addition of a Senior Meteorological Officer and the addition of forecasters providing a 24-hour forecasting service. Prior to this, it had been a Type 4 meteorological office, consisting mainly of Interpreters, who were junior staff making weather observations without any forecasting officers (Air Ministry, 1954: 71).

WAAF personnel began work as Plotters in the Operations Room at No 13 Group on 18 November 1939 (TNA, AIR 25/232), these Clerks, Special Duties, being amongst the first women to be trained in the WAAF. They ultimately replaced RAF personnel at the substitution rate of 75% (Air Ministry, 1953: 97).

Squadron Leader John A Hone of No 13 Group HQ developed what he named as the 'Hone Flight Duration Indicator', described by him as:

> *This is a cheap alarm clock mounted in a wooden block, the shape of which is optional, with a cork dinner mat surrounding the face. The paper clock dial, numbered in reverse, is fixed to the minute hand and revolves with the action of the clock. The type of pin used is obtainable from stationers and is known as a 'lip-pin'. The pin is fitted with the appropriate symbol for Squadron, Flight or Section … and when a Section, etc, is ordered off the ground, the pin is inserted in the cork surround opposite the arrow zero. The clock then automatically gives the exact time a particular Squadron, Flight or Section has been in the air, up*

to 60 minutes. Thus the Group Controller can see at a glance the time spent in the air by a Section, etc, without having to refer to a detailed log. (TNA, AIR 16/14).

By 1 March 1940 the Hone Flight Duration Indicator had been in use in 13 Group Operations Room as well as all four Sector Operations Rooms (Church Fenton, Catterick, Usworth and Turnhouse) and also at Wick for a considerable time and it was therefore decided by HQFC that it should be made standard for all operations rooms, and was rolled out at that time to Nos 11 and 12 Groups. They were installed in No 12 Group Operations Room and all Sector Operations Rooms in that Group area by 27 April 1940 (TNA, AIR 16/14).

The underground protected Operations Block at No 13 Group HQ became operational at 11.59pm on 13 March 1940. Acting Flight Lieutenant Rom Landau was posted to No 13 Group HQ for Operations Room Duties from 23 July to 9 August 1940 (TNA, AIR 25/232):

From outside, nothing could have looked less impressive than the secret sanctum. All I saw was a tiny brick hut surrounded by disintegrating sandbags. The hut contained a minute guardroom with armed guards who examined the visitor's credentials rather more thoroughly than had been done at any of my previous stations. Behind the guardroom and after passing through stout iron gates, we found ourselves at the top of a long staircase leading downwards. After walking down for some time, we reached brightly lit corridors with rubber floors that deadened the sound of footsteps. We descended further still, and finally, a door was opened and we entered a brilliantly lit hall … High above, at one end of the hall, there were glass cages with officers sitting in them like exhibits in some Wellsian film; on the opposite wall, tiny electric bulbs of different colours were going on and off. Throughout the entire place numerous telephone switches were being operated by airmen and WAAFs; dozens of them also performed in robot-like uniformity, functions the meaning of which eluded me. Altogether, the character of the place struck the uninitiated newcomer as tense, efficient, and slightly artificial. No doubt this impression was heightened by the temperature which was that of a hothouse …

The centre of the floor space was occupied by an enormous table, known, as I discovered later, as the Table, surrounded by dozens of airmen and WAAFs and covered with different-coloured discs, little flags, and other gadgets … The top of the Table was formed by a huge map made of rubber, and the discs and plaques upon it represented aircraft flying at the particular time over certain parts of the British Isles. The different gadgets were pushed to and fro across the Table by the many plotters sitting around it and armed with long sticks indistinguishable from those of croupiers. All the plotters wore telephone ear- and mouth-pieces round their heads and each one of them looked after a certain area of the territory covered by our Group …

The large wall at the back of the room was occupied by a graphic representation of the many fighter squadrons that operated under the control of 13 Group. By means of blue, green, red and yellow lights, the state of preparedness and the activities of each squadron, flight and section were shown at a glance.

As I discovered later, the glass-screened boxes on the opposite wall were not really boxes but proper rooms. In the central and largest of them sat the Controller, the man responsible for the tactics of the entire fighter force commanded by our group. Looking down upon the Table in the centre of the room, known as the Floor, he could constantly see the number, position, height and speed of every British or enemy aircraft in the air at the particular moment. Next to him sat the Ops officer, half-hidden by a vast switchboard. The somewhat smaller glass cages on the right and on the left contained various intelligence and liaison officers of the Army and Navy. Below the glass cages and slightly raised from the floor, there was a narrow dias running the full width of the room. Most of its space was occupied by switchboards behind which sat the representatives of the Observer Corps, another Ops officer and several airmen and WAAFs whose job it was to trace on charts the course of enemy aircraft.

At first the general scene, as well as the various activities in the Ops Room, seemed bewildering, yet I guessed that for all its complexity, the work was far less difficult than it appeared to a novice. Except for the Controller and one or two other officers, everyone was performing functions that were to a great extent purely mechanical and demanded neither individual initiative nor thought. All that seemed required was a grasp of the underlying method and precision in execution (Landau, 1945: 241-242).

My proper instruction began on my fourth day … So as Ops officer I began to train, trying each day afresh to forget everything that might have been, and to squeeze out of the job every ounce of interest that it had to offer.

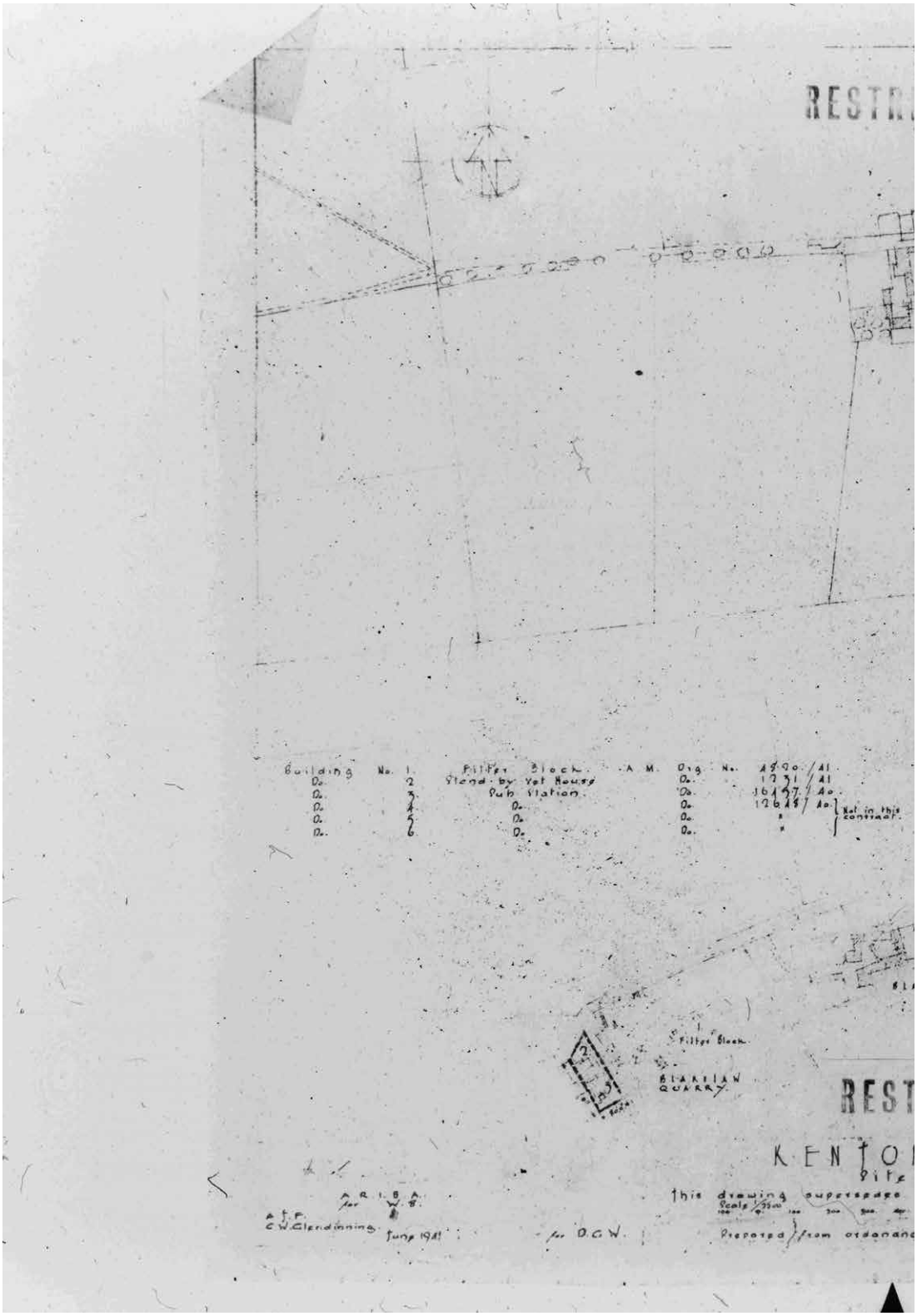
The Ops officer sat in the Controller's room, that is to say in the central and largest of the various glass cages at the back of Ops Room. It was his job to collect for the Controller all relevant information, to be his messenger and telephone operator and to act in general as his factotum. It was he who would get the kicks if the Controller made a mess of things and who naturally could not reply in kind. The place he occupied in the glass box was on the Controller's left behind a long telephone switchboard. By means of this formidable instrument, he collected all the necessary information from the various Sectors, Observer Centres, fighter squadrons, Fighter Command, Navy and AA liaison, and half a dozen other places. At moments of poetic fancy he might regard himself as the centre of a definite universe - by no means one without significance and power - with his finger on each individual pulse which sent the life-stream through it. But though he was a centre, he was a purely passive one, with no will or initiative of his own, rather like a loudspeaker through which the voices of great men may resound.

He had to follow each movement on the Table, and be aware of every phase of whatever aerial combat was taking place over the area controlled by 13 Group; operate his switches, talk to several different places almost simultaneously, and keep a log book. Yet for all the intricacies and responsibilities of his job and for all the exaltation of his title, Air Staff Operations Officer, he was really little more than a telephone operator with the work of three telephone operators in one.

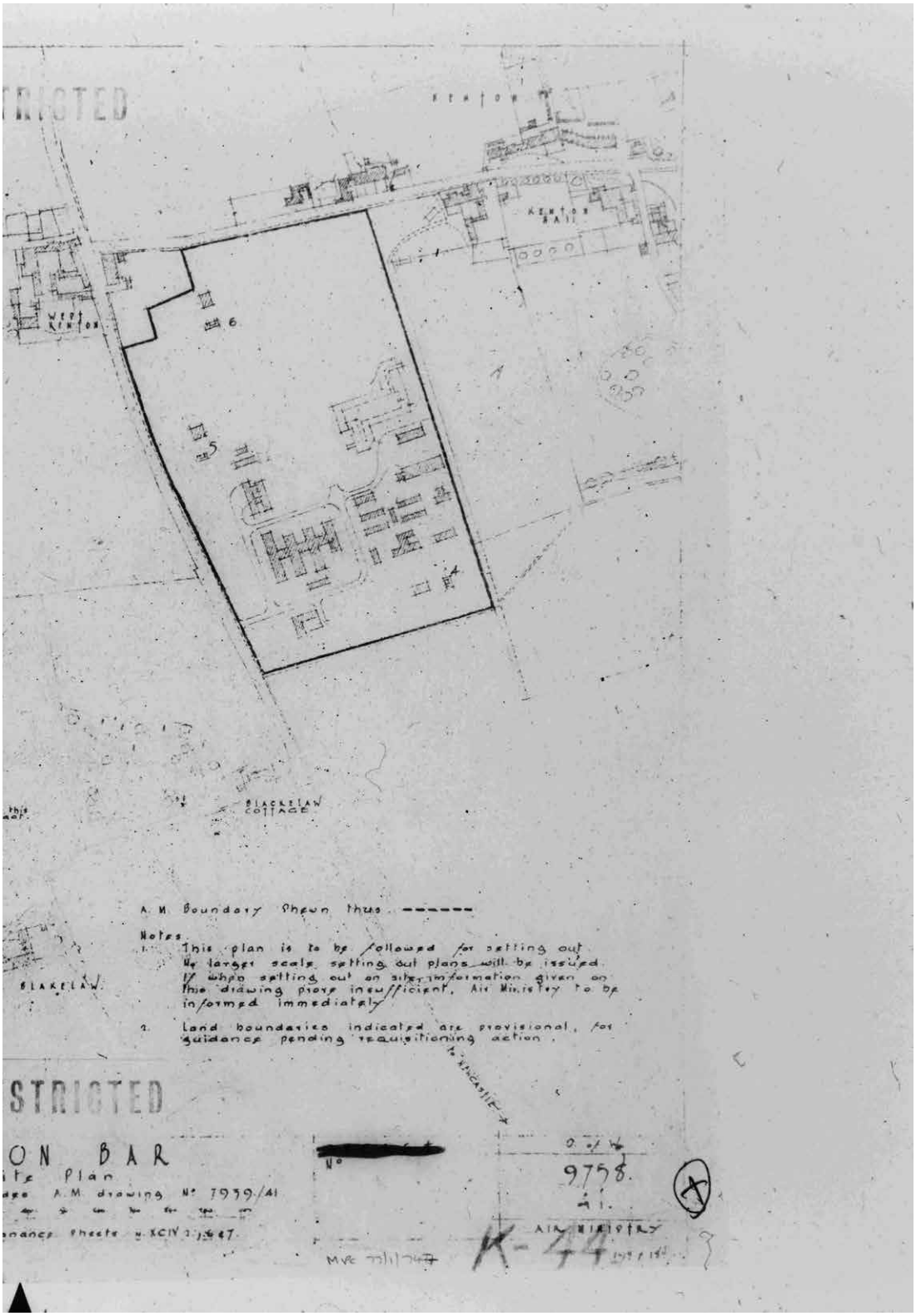
Once you had got used to the complicated picture in front of you, had learned the meaning of the various symbols employed, and the correct procedure, the job was far easier than it appeared at first … On my first day of training I spent the morning sitting next to the Ops officer, trying to learn about the various gadgets on the Table below, and especially about the jargon employed in the Ops Room. At first that jargon appeared quite entertaining. Each individual air raid enacted on the Table was provided with its own number or letter. Its position was given by reference to the chessboard-like squares into which the whole Table was divided (Landau, 1945: 244-245).

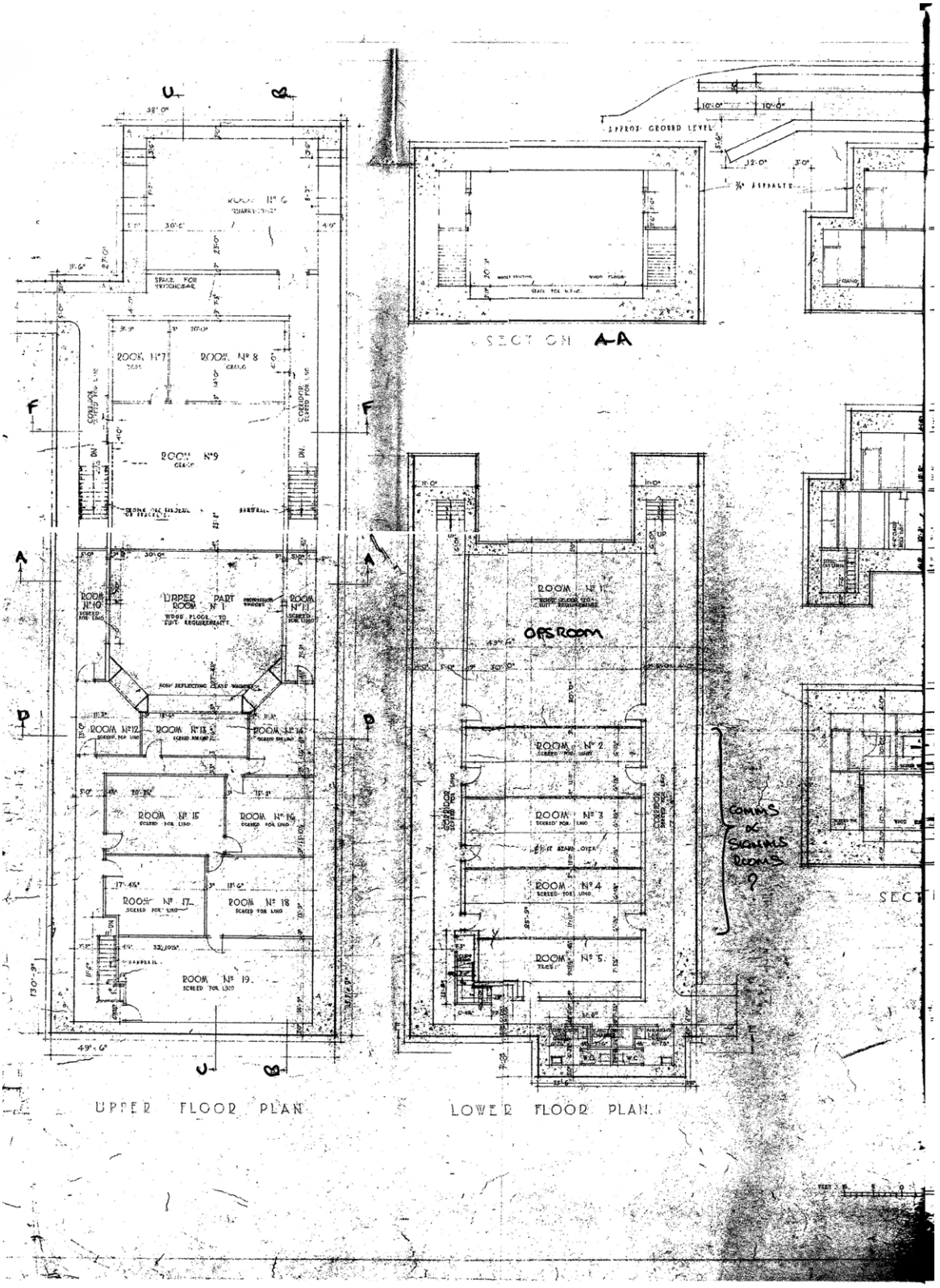
In his diary, Acting Flight Lieutenant Landau described one of his shifts in the 13 Group Ops Room:

Once again I am sitting in the Controller's room, behind the Ops officer's switchboard. After a few days' instruction, the whole procedure seemed quite simple and the authorities decided that I could do the job on my own. In consequence, I have been put on regular duties and am now doing Ops officer work in routine watches. It is an exceptionally quiet day and though for some twenty minutes two German raiders were shown on the Table, they faded out eventually and the Table is practically empty except for a few of our own fighters and Coastal Command aircraft patrolling the coast. The Controller on my right is engrossed in a thriller - Penguin edition - and the Intelligence officer on the left, whom I can just see through his glass wall, is napping. At the Table below only even plotters are sitting: one of them is reading a Sunday paper, another is smoking. Five of the plotters are WAAFs. One of them, a pretty fair-haired girl who looks as though in her pre-military days she had been a mannequin or a chorus girl, files her nails. A second gazes drowsily into space, and the other three are busy knitting pullovers, one in khaki, one in RAF blue and the third in light jade green. For the life of me I cannot think of any service in which that colour is ordre du jour. *The lights are dimmed and the entire atmosphere pervading the room is that of a sleepy Sunday afternoon. A flicker of life appears only when the plotters round the Table receive some new message through their telephone earpieces - which, however, does not happen frequently. The plotter then pulls out a fresh celluloid arrow, red, blue or yellow, and pushes it with his long croupier's stick across the Table into its right position* (Landau, 1945: 246)

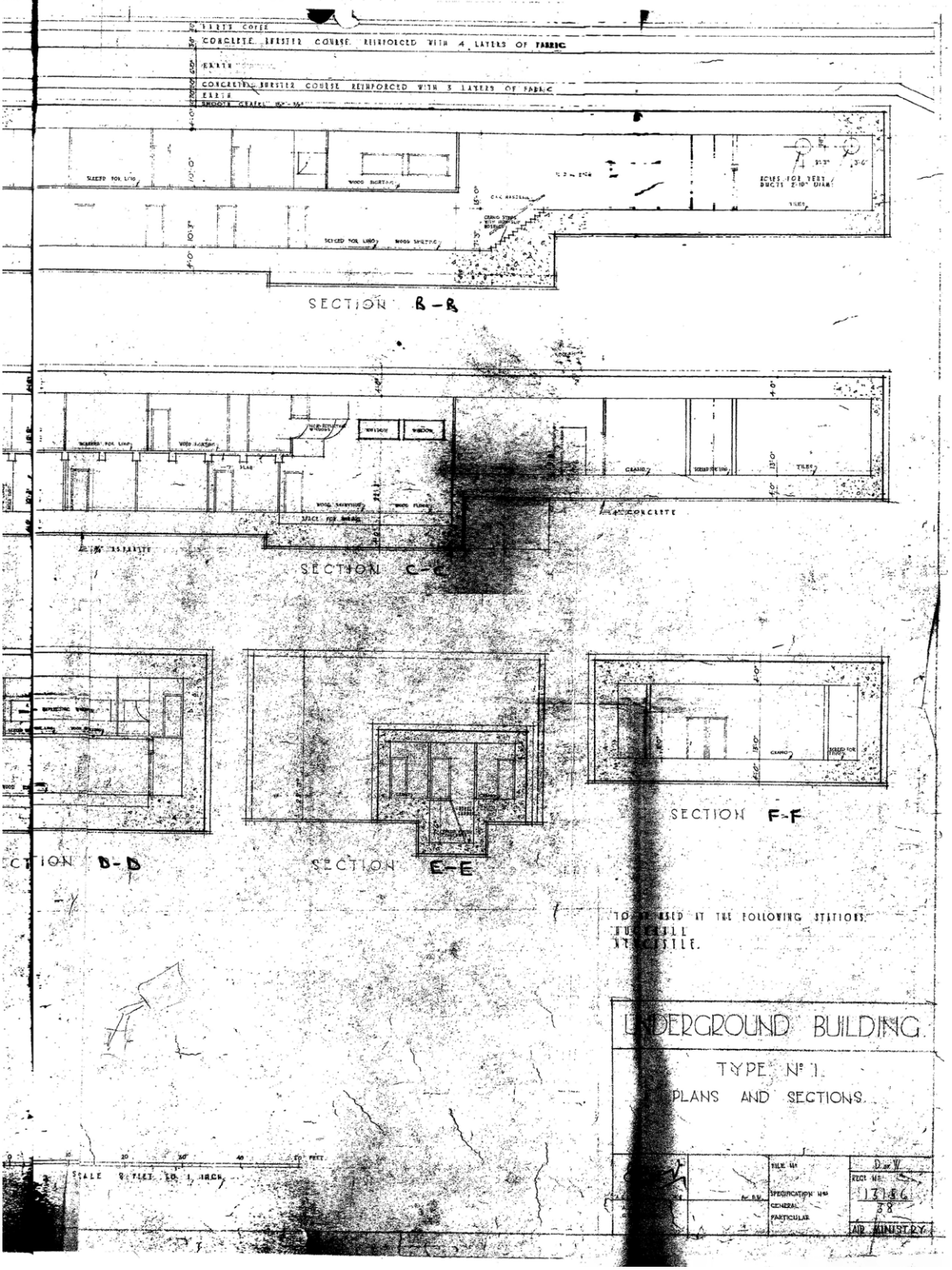


77 No 13 Group Headquarters site plan dated June 1941 (© Crown Copyright Royal Air Force Museum London MFC-78-24-0747).


A.M. Boundary Shewn thus. ------
Notes.
1. This plan is to be followed for setting out. No larger scale setting out plans will be issued. If when setting out on site, information given on this drawing prove insufficient, Air Ministry to be informed immediately.
2. Land boundaries indicated are provisional, for guidance pending requisitioning action.
BLAKELAW COTTAGE
BLAKELAW
STRICTED
ON BAR
Plan
A.M. drawing No. 7939/41
9758.
AIR MINISTRY
K-44



78 Drawings of the underground Operations Block (via RAF Blakelaw Preservation Group).


CONCRETE, BREEZE COURSE, REINFORCED WITH 4 LAYERS OF FABRIC
EARTH
CONCRETE, BREEZE COURSE, REINFORCED WITH 3 LAYERS OF FABRIC
EARTH
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
TO BE USED AT THE FOLLOWING STATIONS.
UNDERGROUND BUILDING.
TYPE N° 1.
PLANS AND SECTIONS.
SCALE 8 FEET TO 1 INCH.
AIR MINISTRY.

Joe Eltringham was an Anti-Aircraft Gunner posted to No 13 (Fighter) Group Headquarters in October 1940, having served there previously before a posting to Orkney:

> *The RAF officers, if I remember right, were regular Royal Air Force, First World War pilots brought from reserve and RAFVR of various ranks whilst the male Other Ranks appeared to be regulars. The Signals were made up of ex GPO engineers. The WAAF arrived during my first attachment mostly, I believe, from the Royal Corps of Ballet and Edinburgh Art School! Most of the officers with whom we gunners came in contact were friendly, and in our view, efficient. One or two of the very senior officers of WWI* [First World War] *vintage were great men who would regale us with tales of their exploits in Bristol Fighters and the like! …*
>
> *The whole atmosphere of the Ops Room was always one of calm, quiet and efficiency. Of course, one could sense the feeling of excitement when raids developed and our fighters were engaging but no-one ever over-reacted … There was, of course, a lot of waiting about in the Ops Room and this was used by most people reading and, in the early days especially, by exercise runs with the sectors and guns* (Joe Eltringham, pers comm, via RAF Blakelaw Preservation Group).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Group area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 3 GOR, a Class 'A' Type 1 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries.

Mrs Nancy Worrall (Barnett) served as a WAAF Teleprinter Operator in the Filter Room:

> *I was a Teleprinter Operator at … Headquarters 13 Group, Newcastle-upon-Tyne … Just after D-Day I moved up, I had been an office worker, I was a typist, sorter and all that kind of thing, office worker, so I think they tried to fit you in to what you were used to doing which you would naturally be better at than other people that didn't do that sort of thing. We were sent to Cranwell for a three month course and became Teleprinter Operators and then, I don't know how, but I was sent to Headquarters straight away at 12 Group at Watnall … They said "You might've been typists, you can forget that." Although it looks something like a typewriter the function's completely different … The messages all came in code, five letter code, I used to long to sit down and interpret them. A long sheet of paper … and there must have been about ten five-letter things, they were strips. When that left your fingers straightaway it was going to go. There was no way anybody could break into it or anything like that.*
>
> *Each Group had so many bases, about 11 or 12 … you were all connected … We were connected right through the country really but normally all our messages went to our own Group. You didn't dare take on with you a drink, bit of food,*

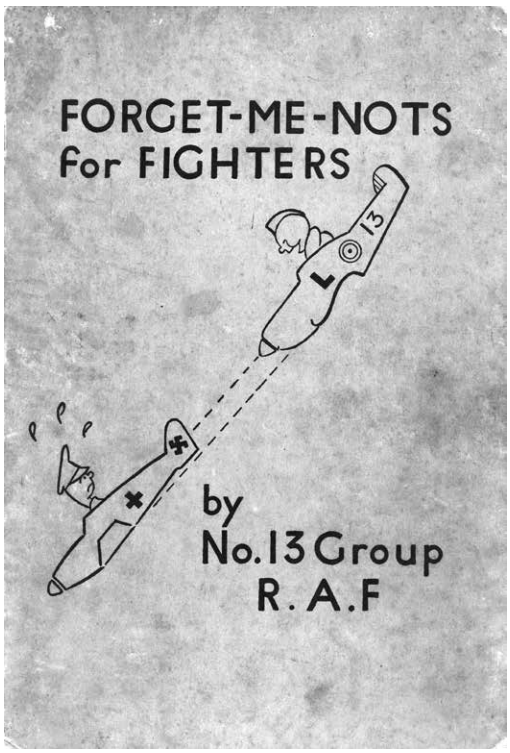
> *anything. Nothing had to touch those signals that you were sending or getting. Nothing! … It was split up, the 24 hours was midnight to eight in the morning, and that to four o'clock, four o'clock to midnight and that was seven days a week always. There was no breaks or anything like that.*
>
> *I was in the bunker where they had the signallers, but it was still connected upstairs. What we had to do was I came out of the camp where we were living in and then had to cross this field, turnips growing in it and everything, you went down a hole in the ground, and the only way we knew how to get in, well they told us where it was like, they left a broken down piece of railing in the middle of the field, so you went there and you ducked down this hole into the hole downstairs. That was the entrance* (Nancy Worrall, pers comm, via RAF Blakelaw Preservation Group).

No 13 Group became well known within RAF Fighter Command for publishing a guide to fighter tactics, using humorous cartoons by Aircraftman Hooper to make the advice more engaging. This book was entitled *Forget-Me-Nots for Fighters* and published in 1940.

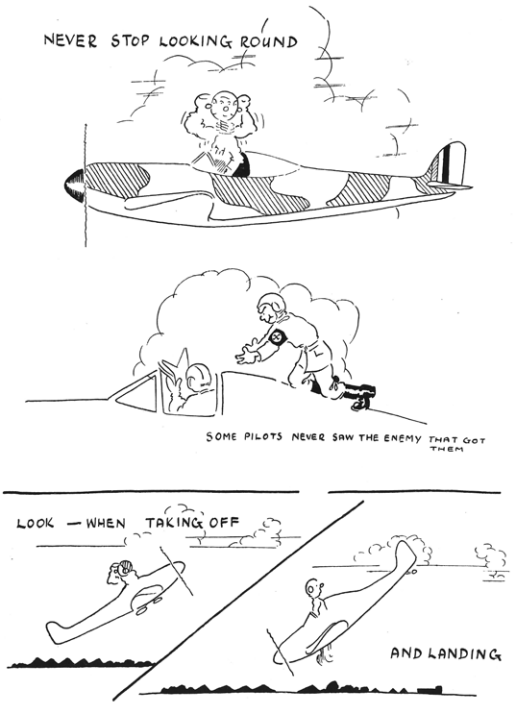
At 12pm on 3 September 1941 the Filter Room opened at 13 Group HQ Newcastle. There was only one track in the 13 Group area at the time and the change-over from Stanmore Filter Room was made by the Post Office without a hitch. Both the Air Officer Commanding No 13 Group and the Senior Air Staff Officer at 13 Group complimented the filter room staff on the improved service provided compared with Stanmore (HRA, HQ No 60 Group RDF Bulletin, August/September 1941).

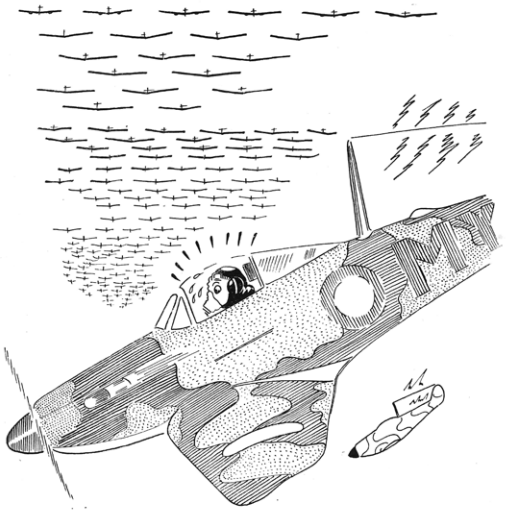
On 4 November 1941 the Watch Establishment for the Group Operations Room at Newcastle was set by Headquarters Fighter Command as:

Floor Supervisor	1 Flight Sergeant
Assistant Floor Supervisor	1 Sergeant
Ops B	1 Sergeant
Ops B1	1 Aircraftman
Ops B2	1 Corporal
Ops B3	1 Corporal
Ops A	1 Aircraftman
Command Tellers	2 Corporals
Inter-Group Tellers	2 Corporals (Telling positions to HQs 9, 12, 14 and 82 Groups)
RDF Plotters	7 Aircraftmen (Plotting positions from HQs 9 (2 positions), 12 and 13 Groups (4 positions))
ROC Plotters	10 Aircraftmen (York 9 Group, York 10 Group, Durham, Galashiels, Dunfermline, Dundee, Glasgow, Oban, Carlisle, Lancaster)
Inter-Group Plotters	4 Aircraftmen (Plotting positions from 9, 12, 14 and 82 Groups)



79 *Forget-Me-Nots for Fighters*, published in 1940, which contains useful advice for fighter pilots, including "never stop looking round. Many pilots shot down never saw the enemy fighter that got them" and "maintain R/T silence unless you have something important to say," using cartoon-style drawings by Aircraftman Hooper to illustrate each point.





Raid Recorders	1 Corporal & 1 Aircraftman
Air Raid Warning Orderlies	2 Aircraftmen
Liaison Orderly	1 Aircraftman
Friendly Aircraft	
Movement Recorders	1 Corporal & 1 Aircraftman
NCO in charge	1 Warrant Officer
NCO Assistant	1 Flight Sergeant
Map Tracers	1 Corporal & 1 Aircraftman (TNA, AIR 2/3546).

At 1pm on 1 July 1943 the 13 Group Filter Room closed down and a party was held in the former filter room that evening to mark the occasion. The Group Operations Room closed down at 8am on 15 July (TNA, AIR 25/233). On that day, 15 July 1943, No 13 (Fighter) Group at Newcastle was merged into No 14 (Fighter) Group at Inverness, which was then re-numbered as No 13 Group. As a result, the Group Headquarters at Newcastle was no longer required (TNA, AIR 25/250) and the Operations Block became a Fighter Sector Headquarters within No 12 (Fighter) Group. This became the Sector Operations Room for Catterick Sector on 15 August 1943 and also Ouston Sector on 30 August 1943 (TNA, AIR 28/62).

Oban

Unit	FSHQ
Region	Argyll and Bute
NGR	NM 9087 3544 (Connel airfield)
NMRS	NM93NW 59
In use	not operational

This was the FSHQ for the planned Oban Fighter Sector. As the sector was never operational, this FSHQ was never used for its intended purpose. It was used between 1962 and 1973 as office accommodation for HQ No 27 Group, Royal Observer Corps (Wood, 1992: 274).

Oban

Unit	Gun Operations Room
Region	Argyll and Bute
NGR	NM 9084 3473 (Lochnell Hotel)
NMRS	NM93SW 19
In use	1942 – mid-1943

Instructions were received by 3rd Anti-Aircraft Division on 13 January 1940 indicating that AA defence would be required for naval anchorages in the vicinity of Kyle of Lochalsh and Oban by April 1940. The General Officer Commanding 3rd AA Division attended a conference at the Admiralty on 18 January 1940 on the requirements for the combined services at Kyle of Lochalsh and Oban. A

reconnaissance was carried out in both areas on 23 January 1940 by Lieutenant-Colonel R Rathbone, Major HA Hounsell and combined services staff (TNA, WO 166/2128).

Oban was authorised as a GOR but in July 1942 was noted as operating as a Gun Control Centre with a telephone line to Oban ROC Centre (TNA, WO 166/7369). The telephone line to Oban GCC was put temporarily out of service on 20 August 1942 (TNA, WO 166/7371). Oban was upgraded to a full GOR before 29 April 1943 (TNA, AIR 16/675). The HAA batteries in the Oban GDA were unarmed by 10 November 1943 (TNA, WO 166/11169) so the GOR probably closed in the second half of 1943.

Oban

Unit	Observer Centre
Region	Argyll and Bute
NGR	NM 8567 2962 (Telephone Exchange, Drimvargie Terrace, Oban)
NMRS	NM82NE 179
In use	circa October 1940 – mid-1943

Unit	Emergency Centre and Observer Centre
Region	Argyll and Bute
NGR	NM 8575 2974 (Linesman's Room, GPO, Albany Street, Oban)
NMRS	NM82NE 154
In use	1940 – mid-1943 (Emergency Centre), mid-1943 – 12 May 1945 (Observer Centre)

On 3 June 1940 Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command, wrote:

> *I consider immediate steps are required to expand the Observer Corps organisation to keep pace with the expansion of the Home Defence Organisation. The Observer Corps system must be extended to provide the defences with air intelligence … in Scotland, where I consider that a coastal fringe of observers is needed as far as Cape Wrath, with additional observer posts where practicable … I have therefore given instructions to the Commandant, Observer Corps to take immediate action to meet these requirements. This action will have the following results: … the formation of another Observer Group (No 35) in the west of Scotland with Centre at either Oban or Fort William, whichever is likely to be most convenient for GPO circuits* (TNA, AIR 16/50).

No 35 Observer Group was formed in August 1940 (*The Oban Times*, 26 August 1944) and became operational circa October 1940 (TNA, AIR 2/20163, AIR 2/20164, AIR 2/20168, AIR 2/20468). The Controller was CA MacAllister (Wood, 1992: 274) and the Observer Group Officer from 1 July 1940 until March 1943 was Major James G Struthers, DSC, with the Group Headquarters at his home, Armaddy Castle, near Oban (Struthers papers).

80 Jim Struthers in ROC uniform, with his wife Enid at Armaddy Castle (© Charles Struthers).

Selection of sites for Observer Posts began in July 1940 (TNA, AIR 2/20163, AIR 2/20468). In the case of Fort William Post, for example, Major Struthers noted on 12 July:

> *The five best sites in this area have been taken by the Anti-Aircraft Division (3rd). The site most suitable for Observer Corps requirements is that at Clach-na-Harray and as this site is only a few hundred yards from the Head Observer's house, it is in all ways imperative that this site be used by the Observer Corps. The ground belongs to the North British Aluminium Co Ltd and their representative, Col Laughton is quite agreeable to our using it. The Officer Commanding the anti-aircraft posts in the area (Major Dacker) is also quite agreeable. The Group Commander, Col Baillie of Dochfour, whom I met on the site by appointment, wishes us to get permission from the Divisional Commander of 3rd Anti-Aircraft Division, 18 Melville St, Edin and has mentioned the matter personally, signifying his own approval … It is regretted this Post could not be arranged locally but it is thought no difficulties should arise and the position is very much the best from our point of view* (TNA, AIR 2/20468).

On 2 August 1940 permission was given by the North British Aluminium Company Limited to establish an Observer Post on their property and by 15 August a hut

had been erected on the site, which was described as a "very fine site between Old Inverlochy Castle and main road and adjoining Anti-Aircraft Battery. Good all-round vision" (TNA, AIR 2/20468).

The Observer Posts within No 35 Group were as follows:

A.1	Laggan	NN 299 984 (Oct 1940 – May 1945)
A.2	Spean Bridge	NN 2093 8232 (Apr 1943 – May 1945)
A.3	Fort William	NN 122 754 (Oct 1940 – May 1945)
A.4	Tulloch (Watcher Post)	NN 372 808 (Dec 1940 – Apr 1942)
A.4	Tulloch	NN 371 810 (10 Sep 1942 – May 1945)
B.1	Crianlarich	NN 386 249 (Oct 1940 – May 1945)
B.2	Dalmally	NN 143 277 (Oct 1940 – May 1945)
B.3	Bridge of Orchy	NN 299 418 (Dec 1940 – May 1945)
C.1	Onich	NN 016 617 (Oct 1940 – May 1945)
C.2	Taynuilt	NN 001 302 (Oct 1940 – May 1945)
C.3	Oban	NM 908 353 (Apr 1943 – May 1945)
C.4	Appin	NM 923 480 (Oct 1940 – May 1945)
C.5	Kinlochleven Dam (Watcher Post)	NN 248 603 (Dec 1940 – Jan 1941)
C.6	Glen Etive (Watcher Post)	NN 124 462 (approx)
D.1	Strontian	NM 807 624 (Oct 1940 – May 1945)
D.2	Kingairloch	NM 859 522 (Oct 1940 – 4 April 1944)
D.2	Lochaline	NM 674 452 (4 April 1944 – May 1945)
D.3	Salen	NM 689 660 (Oct 1940 – May 1945)
E.1	Mallaig	NM 676 967 (Oct 1940 – May 1945)
E.2	Arisaig	NM 6490 8727 (Apr 1942 – May 1945)
E.3	Glenfinnan	NM 9089 8068 (Apr 1941 – May 1945)
F.1	Arrochar	NN 287 042 (Oct 1940 – May 1945)
F.2	Garelochhead	NS 238 927 (Apr 1943 – May 1945)
F.3	Inveraray (Town Hall Roof)	NN 096 084 (Oct 1943 – May 1945)
F.4	Minard	NR 976 964 (Oct 1941 – May 1945)
G.1	Arduaine	NM 793 106 (Oct 1940 – May 1945)
G.2	Lochgilphead	NR 875 856 (Oct 1940 – May 1945)
G.3	Tarbert	NR 869 686 (Oct 1940 – May 1945)
G.4	Seil Island	NM 7426 1766 (Jul 1941 – May 1945)
H.1	Ardnamurchan (WOU)	NM 4182 6728
H.2	Tobermory (WOU)	NM 501 564 (approx)

H.3	Dervaig (WOU)	NM 445 520 (approx)
H.4	Coll (WOU)	NM 2475 6272
J.1	Tiree (WOU)	NM 0149 4729
J.2	Iona (WOU)	NM 2666 2275
J.3	Colonsay (WOU)	NR 388 950 (approx)

(TNA, AIR 2/20160, AIR 2/20161, AIR 2/20162, AIR 2/20163, AIR 2/20164, AIR 2/20168, AIR 2/20169, AIR 2/20170, AIR 2/20171, AIR 2/20172, AIR 2/20173, AIR 2/20318, AIR 2/20468; ROC Museum, WOU reporting to Oban Centre; *The Oban Times*, 5 June 1943; Wood, 1992: 323-324, 327-328, 332).

On 22 December 1940 Fort William was attacked by the German Air Force. A Junkers Ju 88 dropped two bombs near the aluminium works at 8.50am (TNA, AIR 25/250). The report on this raid by the OGO, Major JG Struthers, DSC, makes interesting reading:

> *The raider approached from the north-west and was advised by A.1/35 Group, Laggan, and by A.2 Spean Bridge. It passed to the west of A.3 Fort William, about three miles out, and then turned west of Corpach on Loch Eil, approaching Fort William for the attack on the works nearby. The Post functioned very well and the Head Observer was on duty with the two regular Observers at the time of the incident. Two bombs were dropped, one striking the River Lochy at the north-west bastion of old Fort Inverlochy Castle, the other some 150 yards to the north-east. This last was a direct hit on a dug-out shelter and completely obliterated it. It just missed the farmhouse which is tenanted by the Head Observer, and blew in every pane of glass in the house and cracked the walls. At the precise moment of the attack I was speaking to the Centre through the Observer Corps line and heard all the reporting, the Head Observer actually saying, "It's got my house." The reporting continued, and the plane passed out of the area. The Head Observer then went to inspect the house. Fortunately, his wife having influenza, he had arranged an alternative shelter in the farmhouse as a precautionary measure, and the family had not used the dug-out shelter. I saw the Head Observer next morning and, although his house was shattered, he was continuing his Observer Corps duties as well as supervising the clearing up of the damage. His calm bearing throughout the incident is to be commended* (Winslow, 1948: 186).

Due to a shortage of men for Observer Corps posts in the North-West Highlands, No 18 Wireless Observer Unit (also known as No 18 Wireless Unit) comprising RAF personnel was used to perform a similar role, sending reports of aircraft movements to Oban Observer Centre (Hughes, 1998: 93). Peter Whitworth served on Coll with the unit:

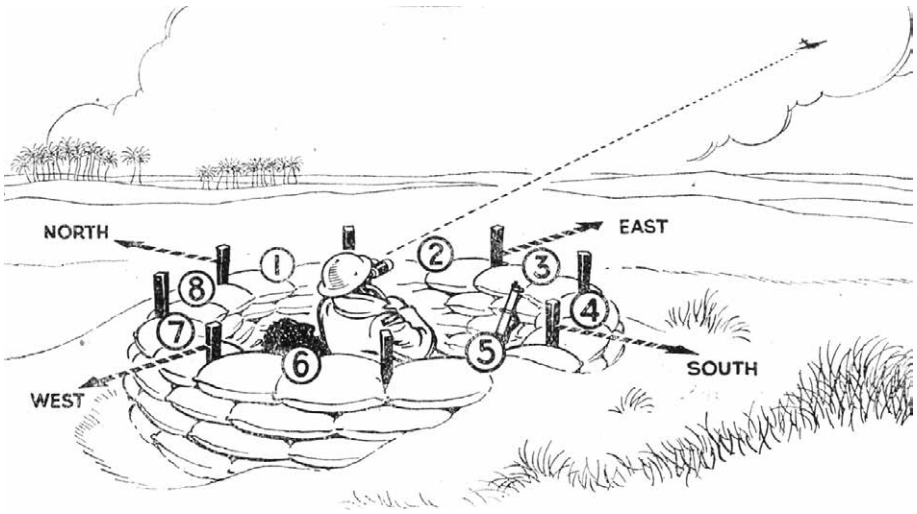
> *In 1942 I was on a wireless unit which covered the Western Isles. We were small wireless units plotting aircraft 24 hours a day. The HQ for our unit was a few Nissen huts at the rear of the harbour in Oban (Hughes and Holliday, 2012: 65).*

81 Women Observers outside Oban Centre (Back L-R: Eadie Parsons, Cathy MacCulloch, Fiona Tindall (Currie), Annie MacGregor. Front L-R: Morag MacIntyre (Campbell), Ishbel Little (MacCallum), Jean Campbell (© Oban War and Peace Museum).

> *We had units on Iona, Mull, Ardnamurchan, Colonsay and Tiree and Coll. Our unit on Coll was located about two miles from Arinagour* [actually five miles] *in a pre-war shooting lodge, from where we plotted aircraft twenty-four hours a day. We were the only military on the island and so had to deal with any bodies washed ashore. We would occasionally plot unidentified or German aircraft and sometimes see Allied aircraft coming back with engines out or having suffered damage in action* (Hughes, 1998: 93).

One of the posts of No 18 Wireless Observer Unit was at Ardnamurchan, where Pat Shute was posted in 1941:

> *Here we occupied two Nissen huts which served as sleeping quarters, mess, cook house and stores. They were situated overlooking a small bay below the point. The observer post and wireless shack were on the headland above the lighthouse. Our job was to watch the skies for aircraft, identify them, plot height and course and transmit details to Oban.*



82 Drawing of a typical Wireless Observer Unit post (TNA, AIR 10/4040).

> *At the nearby village of Portuairk we were made most welcome. We were allowed one liberty run in our truck per week. We saved this for Sunday and picked up local folk on the road going to the Kirk at Kilchoan. It was our way of repaying their kindness* (Hughes, 1998: 91).

The WOU post on Coll was identified by surveyors working for Ordnance Survey in 1972 and described as measuring 4 metres square and made of cut turf and sandbags, with wooden pit props providing revetting (NMRS site record for NM26SW 30). Although the pit props may indeed have provided revetting, their main function was to divide the post into eight segments, indicating the main compass points to allow for quick and accurate reports. The bearing of an aircraft seen or heard would be reported by the segment number in which it was positioned. Distance and height were estimated by the observer. Raid information was passed by the Wireless Operator at the post in code consisting of two groups of five numerals, as follows:

First Group:	1st numeral	Quantity of aircraft
	2nd numeral	Recognition (or if heard only)
	3rd and 4th numeral	Height of aircraft in thousands of feet
	5th numeral	Direction of flight of aircraft
Second Group:	1st and 2nd numerals	Post number
	3rd numeral	Segment number of aircraft position
	4th and 5th numerals	Distance in miles of aircraft from Post

(TNA, AIR 10/4040).

On 8 November 1942, 'A', 'B', 'C' and 'D' Squadrons of No 18 Wireless Observer Unit, which had given inland coverage in the North and Western part

of No 14 (Fighter) Group area when there was insufficient population to man Royal Observer Corps posts, became non-operational, and on 30 November were disbanded (TNA, AIR 25/250, AIR 25/252).

In 1943 as part of the re-organisation of the ROC, the new position of Group Commandant was created, and that of Observer Group Officer deleted. The Group Commandant for No 35 Group was, from March 1943 to 23 June 1944, Observer Commander JG Struthers, DSC (Struthers papers), and from 1944 to 1945 was Observer Commander DAJ Boyle (Wood, 1992: 274). The Observer Centre moved from the Telephone Exchange in Drimvargie Terrace to the GPO building in Albany Street in mid-1943, remaining there until stand-down (TNA, AIR 2/20164, AIR 20/5357).

A journalist from *The Oban* Times visited Oban Centre in 1943 and described their visit:

> *On entering the operations room at the Centre one finds a table with a map of the area in four counties for which the Centre is responsible. Round the table are seated the plotters (mostly women), wearing headphones plugged into telephone lines radiating from the table to about thirty Observer Posts sited at various vantage points in this wide district.*
>
> *The plotters receive instant information from the Posts by direct lines, and by means of coloured counters they plot on the table the course and exact position of every aircraft, friendly or hostile, in the area. At the head of each track is a small stand indicating the type, number and height of each 'raid'. Curiously enough, all aircraft in flight are here termed 'raids' although their mission may be entirely peaceful. Quite a number of tracks may appear on the table at the same time, some representing single aircraft, and others 'planes flying in formation. There is thus revealed on the table a true picture of the activity going on in the sky above. We watch the ever changing scene, and we see faithfully recorded the tracks of 'planes perhaps fifty miles away, and flying at various heights.*
>
> *On a raised semi-circular dias round the table are to be found the 'tellers', also wearing headphones. These are specially trained to do a job which calls for coolness and quick thinking. They are connected to various RAF Operations Rooms throughout the country. Their function is immediately to transmit plots as they appear on the table below, so that tracks are quickly reproduced at other distant Operations Rooms.*
>
> *With up-to-the-minute information thus available, Fighter Command are able to give a hot reception to any enemy raiders that may approach our shores. The whole complicated machinery devised for interception comes immediately into action, the guns open out, the fighters intercept, and the alert is given to places where danger threatens.*

> *Not the least important part of the Observer Corps' work is to render assistance to our own aircraft when in distress or off their course. These are often guided to the safety of their bases as a result of information supplied by the Corps. An Argyllshire Post at 5 o'clock one morning saw a flare being dropped 60 miles away. This information, on being passed on, was instrumental in bringing safely to base an aircraft which had lost its bearings …*
>
> *About 60 per cent of the personnel at the Oban Centre are women, but still more women are required, particularly those between 17 and 18½ years of age … Experience has shown that women are particularly suited to the work of Centres, where they do the same sort of job as that performed by WAAF personnel at RAF Operations Rooms* (*The Oban Times*, 20 November 1943).

On 18 April 1945 the ROC Commandant was informed by the Air Ministry Telecommunications Department that it required the release of the Post Office premises occupied as the main ROC Centre in Oban. The ROC sought details of possible alternative accommodation which could be made available for post-war functioning if and when required (TNA, AIR 20/5343). However, less than a month later Oban Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Ouston

Unit	FSHQ
Region	Northumberland
NGR	NZ 0840 6917 (Ops Block, Air Ministry Drawing No 16266/39)
In use	10 March 1941 – 15 July 1943

RAF Ouston opened on 10 March 1941. The Fighter Sector Headquarters was transferred from Usworth, with the changeover in operational control taking place at 2pm (TNA, AIR 28/624). A period of transition in which Ouston replaced Usworth as the Sector Headquarters followed. The various sections gradually transferred from Usworth to Ouston, with the move of the Sector Headquarters completed on 15 March 1941 (TNA, AIR 28/870).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 201 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries.

Enemy activity on 14 March 1941 began at 8pm when three raids, each comprising a single aircraft, approached Tynemouth from the east. This proved to be the advance element of an attack which lasted until 1.55 am on 15 March. Aircraft approached from the east, south-east and south-south-east on the east coast, and from the south on the west coast and passed across Ouston Sector towards Glasgow. No fighters were scrambled from the sector due to the bad

weather conditions, but anti-aircraft guns in Tyne Gun Defended Area opened fire, although without success (TNA, AIR 28/624).

At 11pm on 5 May 1941 raids began to approach the Yorkshire coast north of the Humber, heading west, some spreading north into Ouston Sector. The raid density increased and raids were crossing the coast south of the Farne Islands, continuing north-west across the sector towards Glasgow. A stream of enemy aircraft on the west coast also developed, some of these passing through the Sector. In total, more than 80 aircraft passed through the Sector heading for Glasgow and Clydeside. Boulton Paul Defiants of No 141 Squadron and Hawker Hurricanes of No 317 Squadron patrolled the coast from Yorkshire north and a Defiant shot down a Heinkel He 111 off Druridge Bay (TNA, AIR 28/624).

The following night between 50 and 60 enemy aircraft again passed through the sector from the south-east from around 11pm onwards, heading for Clydeside. Ouston airfield was bombed by a single Junkers Ju 88 at 12.15am on the morning of 7 May, with several bombs landing on the hangar, destroying a Hurricane, a Westland Lysander and a de Havilland Hornet Moth. Defiants of No 141 Squadron carried out patrols off Tyne, Blyth and Seaham and one Defiant destroyed a Heinkel He 111 in the Morpeth area (TNA, AIR 28/624).

At approximately 12.20pm on 10 May 1941, Raid 506 comprising one aircraft at 20,000 feet approached the sector from Lanark, flying south-east towards Otterburn, but was suddenly re-plotted at St Abb's Head flying east at 4,000 feet. It faded and was reported as having been engaged by a fighter from Drem but then re-appeared 40 miles east of Berwick-upon-Tweed at 7,000 feet, climbing to 16,000 feet. White and Red Sections of No 317 Squadron patrolled Ouston on account of this raid (TNA, AIR 28/624).

Later the same day, at 10.08pm, Raid 42, which was plotted as 1+ aircraft below 9,000 feet, approached the sector from the south-east. Radar tracked the aircraft as heading towards Lindisfarne and turning east before fading, but these may have been confused with White Section of 72 Squadron who were searching in the area. The true position of the enemy aircraft was given by the Royal Observer Corps as it proceeded inland from Acklington towards Wooler, then jumping to Hawick and out of the Sector. A Supermarine Spitfire, Yellow One of 72 Squadron was airborne from 10.21pm until 11pm. Although initially ordered to patrol Acklington it was instructed to intercept the raid, but the plots jumped too far ahead of it and it was unable to catch the enemy aircraft which was flying at high speed. It was reported by the ROC as a Messerschmitt Bf 110 which was surprising at the time but proved to be correct as the aircraft crashed and was found to have been piloted by Rudolf Hess (TNA, AIR 28/624).

On 4 November 1941 the Watch Establishment for the Sector Operations Room at Ouston was set by Headquarters Fighter Command as:

Supervisor	1 Sergeant
Deputy Controllers	2 Sergeants
Ops A	1 Aircraftman
Ops B1	1 Aircraftman

ROC Liaison Teller	1 Corporal
Bomber Plotters	2 Aircraftmen
Fighter Plotters	2 Aircraftmen
Triangulator Teller	1 Corporal
Triangulator Setters	3 Aircraftmen
ROC Plotters	10 Aircraftmen (Durham, Galashiels, Carlisle, York 9 Group, York 10 Group, Lancaster, Manchester, Glasgow, Ayr, Leeds)
Fighter Table Plotter/Tellers	2 Aircraftmen (Turnhouse, Catterick)
Fighter Table Supervisor	1 Corporal
RDF Plotters	3 Aircraftmen (plotting positions from HQs 9, 12 and 13 Groups)
CHL Plotter	1 Aircraftman (Cresswell)
GCI Plotter	1 Aircraftman (Northstead)
GCI Liaison	1 Corporal
Sector Fighter Plotter	1 Aircraftman
Messengers	2 Aircraftmen (Aircraft Hands)
NCO in charge	1 Flight Sergeant
NCO Assistant	1 Sergeant
Tracer	1 Corporal
Clerk General Duties	1 Aircraftman (TNA, AIR 2/3546).

Starting about 11.30pm on 24 March 1943 some 14 enemy aircraft approached the Ouston Sector from the east between 7,000 and 12,000 feet. One or two of these aircraft joined others operating in Turnhouse Sector, but around 12 crossed the coast between the Tyne and the Farne Islands and carried out a scattered raid over the whole Sector area, mainly between 3,000 and 6,000 feet. Several penetrated as far west as Moffat and the Solway, whilst others flew over Edinburgh and farther west, almost to Glasgow. The raiders appeared to have no specific objective but bombs were dropped, in mainly rural locations over a wide area of Northumberland and the Scottish Lowlands. Enemy air activity had ceased by 1.45am on 25 March (TNA, AIR 28/624). Several of these enemy aircraft crashed into high ground, due to the low altitude they were flying at. A Junkers Ju 88A-14 crashed at Darlingfield Farm, near Earlston in Berwickshire at 12.30am; a Dornier Do 217E-4 crashed at Carsphairn Farm in Kirkcudbrightshire at 12.45am whilst at the same time a Junkers Ju 88A-14 crashed at Hare Hill near Balerno in Midlothian (Ramsey, 1990: 238).

Preparations began on 8 July 1943 for the move of the FSHQ from Ouston to Kenton in Newcastle, with truck loads moving regularly to the new location. The main party moved from Ouston to the new Sector Headquarters at Kenton on 14 July 1943. The transfer of the Ouston Sector from No 13 Group to No 12 Group took effect at 8am on 15 July and the new Sector Headquarters opened at RAF Kenton on the premises formerly occupied by No 13 Group HQ, which had moved to Inverness (TNA, AIR 28/624).

Peterhead

Unit	FSHQ
Region	Aberdeenshire
NGR	NK 1060 4627 (Ops Block, Air Ministry Drawing No 5291/41)
NMRS	NK14NW 503
In use	24 May 1942 – 20 June 1944

On 7 July 1941 RAF Peterhead opened as an airfield in No 14 (Fighter) Group, within Dyce Sector (TNA, AIR 28/637). On 4 November 1941 although Peterhead FSHQ had not yet opened, the Watch Establishment for the Sector Operations Room was set by Headquarters Fighter Command as:

Supervisor	1 Sergeant
Deputy Controllers	2 Sergeants
Ops A	1 Aircraftman
Ops B1	1 Aircraftman
Ops B2	1 Aircraftman
ROC Liaison Teller	1 Corporal
Bomber Plotters	2 Aircraftmen
Fighter Plotters	2 Aircraftmen
D/R Plotters	2 Aircraftmen
Triangulator Teller	1 Corporal
Triangulator Setters	3 Aircraftmen
ROC Plotters	6 Aircraftmen (connected to Aberdeen, Dundee, Glasgow, Dunfermline, Oban, Inverness)
RDF Plotters	2 Aircraftmen (plotting positions from HQs 13 and 14 Groups)
CHL Plotters	3 Aircraftmen (Cocklaw, Rosehearty and Doonies Hill)
CHL Liaison	1 Corporal (Cocklaw CHL used for interceptions)
Messengers	2 Aircraftmen (Aircraft Hands)
NCO in charge	1 Flight Sergeant
NCO Assistant	1 Sergeant
Tracer	1 Corporal
Clerk General Duties	1 Aircraftman (TNA, AIR 2/3546).

Work on the FSHQ at Peterhead was very slow. It was noted on 28 February 1942 that "interior work on the Operations Block is still proceeding slowly" and a month later on 31 March work on the Operations Room continued to progress more slowly than was desirable. Work was nearly complete when the FSHQ was inspected by Group Captain Hatcher, Chief Signals Officer at Fighter Command Headquarters, on 10 April 1942. With this progress, it had been envisaged that the operations room would be ready for occupation at the end of April 1942, but due to technical hitches this was not possible. The Operations Room was finally completed in May 1942, with FSHQ Dyce moved to the new Sector Operations

Room at Peterhead on 23 May 1942, and FSHQ Peterhead taking over from Dyce at 12.01am on 24 May 1942 (TNA, AIR 28/637).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 204 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/82), even though it was not in direct contact with AA gun batteries.

The new Sector Operations Room was almost immediately into action when a Heinkel He 111 was damaged at 11.17pm on 27 May 1942 by Flight Sergeant J Moul flying a Supermarine Spitfire VB of No 416 Squadron 40 miles east-north-east of Peterhead. Further success followed on 4 November 1942 when a Junkers Ju 88 on weather reconnaissance (known as 'Weather Willie') was shot down 130 miles east of Stonehaven by two Bristol Beaufighters from No 125 Squadron flown by Squadron Leader Hughes and Flying Officer Turnbull. The Sector Controller at Peterhead was Squadron Leader Crossley. Another German aircraft was shot down soon after: this combat took place on 10 November when another Beaufighter from No 125 Squadron, this time piloted by Flight Lieutenant Bailey, intercepted and shot down another Junkers Ju 88 'Weather Willie' at 8.36am some 118 miles east of Montrose. The Sector Controller in charge of the interception was Flight Lieutenant Crimp (TNA, AIR 28/637).

BG Morgan was a Sector Controller at Peterhead:

> *Commissioned in 1941 I served as a Coastal Command controller at Stornoway before escaping back to Fighter Command at Kirkwall. There I was trained both as a Sector and GCI Controller. In July 1942 I was posted to Peterhead as a Sector Controller. At that time we sometimes handed over the control of an interception to a controller - F/L Knight - at Cocklaw, but the facilities and liaison were poor and the results disappointing* (Dr BG Morgan, per comm).

In the afternoon of 27 February 1943, the ROC reported to 13 Group an enemy reconnaissance aircraft off the Firth of Tay flying at 30,000 feet identified as a Junkers Ju 86P. The Ju 86, designated Raid 228, was plotted by radar 3 miles east of Montrose heading south. It then turned south-east and was last plotted 140 miles east of the Firth of Tay. The average speed of the Ju 86 was recorded as being 300 mph (TNA, AIR 28/624).

On 27 January 1944 the Senior Flying Control Officer was requested by No 13 Group to make provisional arrangements for the installation of a Triangulator Room in the Control Tower (TNA, AIR 28/637).

A series of photographs were taken in the Sector Operations Room at Peterhead in 1944, showing some of the WAAF Plotters at work. These were taken by an official RAF photographer and all the WAAF were Scottish women. They include sisters Aileen and Joan Hunter Wylie from Bridge of Weir in Renfrewshire. Aileen was born in Johnstone in May 1919 and Joan in Bridge of Weir in December 1922 to Hugh John Wylie, a thread manufacturer, and Jemima Hunter Wylie (née Mitchell) (NRS, Register of Births, District of

83 LACW Joan Wylie (from Bridge of Weir), LACW Mabel Kidson (from Edinburgh) and LACW R Davie (from Aberdeen) at the plotting table in Peterhead SOR in 1944 (© Imperial War Museum London CH11883).

84 LACW Aileen Wylie and LACW Joan Wylie (sisters from Bridge of Weir) at the plotting table in Peterhead SOR in 1944 (© Imperial War Museum London CH11884).

Johnstone, Aileen Wylie, 3 May 1919; Register of Births, District of Kilbarchan, Joan Hunter Wylie, 17 December 1922).

At midnight on the night of 20 June 1944 the Sector Operations Room was closed down and Peterhead Sector ceased to exist. The Sector area was divided between Turnhouse and Kirkwall (TNA, AIR 25/234).

Portree

Unit	Observer Centre
Region	Skye
NGR	NG 4835 4343 (Skye Gathering Hall, Portree)
NMRS	NG44SE 97
In use	3 November 1941 – 12 May 1945

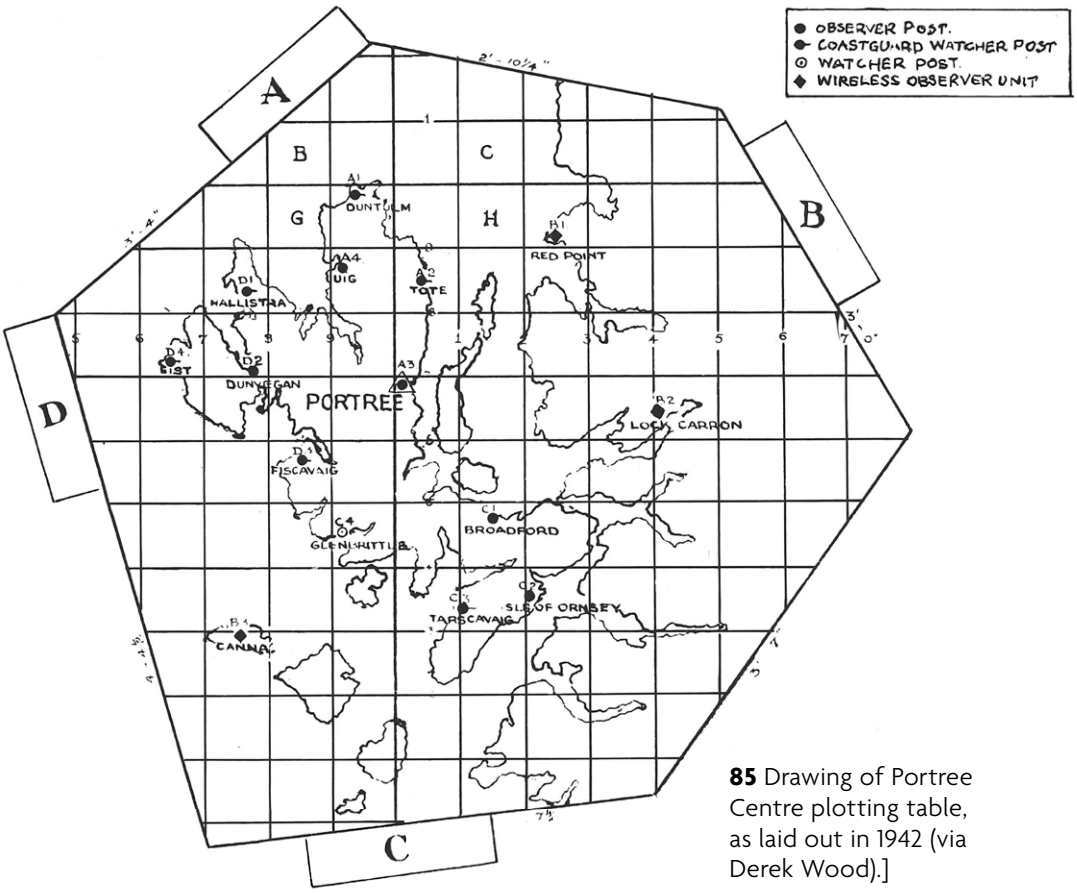
No 40 Observer Group was formed at Portree on 3 November 1941. It was subject to difficulties in recruiting men across the North-West Highlands and thus not only was its Duty Controller a Woman Observer, appointed in August 1942, but the Centre personnel were all women (Winslow, 1948: 179, 185). Indeed, it was only in July 1941 that women observers had been admitted to the Observer Corps (Wood, 1992: 123). Miss Flora Murchison Macdonald, the Duty Controller, was awarded the British Empire Medal for her services, including assisting in recognition training at both the Centre and Posts across the Group (Winslow, 1948: 179). The Observer Group Officer, and later Group Commandant, was Observer Lieutenant Douglas A Donald (Wood, 1992: 124; NRS, Register of Marriages, District of Townhead, Douglas Alexander Donald and Flora Murchison Macdonald, 17 September 1947).

The Observer Centre was in the Skye Gathering Hall (TNA, AIR 20/5357), which was built in 1879 but enlarged and completely remodelled in 1898 by the architect James AH Mackenzie (Gifford, 1992: 546).

The shortage of men across the North-West Highlands, Ross and Cromarty and Sutherland to join the Observer Corps meant that No 18 Wireless Observer Unit (also known as No 18 Wireless Unit) comprising RAF personnel was used to perform a similar role (Hughes, 1998: 93). Three WOU Posts were established within No 40 Group at Red Point, Lochcarron and Canna, sending reports of aircraft movements to a location in Portree and from there to Portree Centre (ROC Museum, WOU reporting to Portree Centre). However, due to the necessity of using code when transmitting plots via wireless, as well as various technical difficulties, considerable delay was experienced in the passing of plots and Observer cover in the North-West Highlands was not considered satisfactory. Use was also made of Coastguards who reported either to a nearby Post or to the Centre in Portree but this also proved unsatisfactory (Winslow, 1948: 185).

Peigi Bennett was a Teller in the Portree Centre:

> *It was in the Skye Gathering Hall … in the middle of the room there was this huge table with the map … the map was sectioned with different letters of the alphabet … I was a Teller, well the Tellers were on a platform a few yards away from the*



85 Drawing of Portree Centre plotting table, as laid out in 1942 (via Derek Wood).]

86 Personnel of Portree Centre with Scottish Area Commandant, Air Commodore R Peel Ross, photographed outside the Centre, circa 1942 (© Skye and Lochalsh Archive Centre).

table and above the table on a platform, and we had to get in touch with all the other outside posts, I think there were about five on the island, by telephone. We had a direct line to all the outside ROC posts … We were connected to the mainland as well, especially Ross-shire … I only worked there for six months … It's not only the enemy planes we had to chart, we had to chart any *plane … The tellers got in touch with the outdoor posts, and you had a code for telling the exact position of the planes, and then we would pass the message onto the people who were doing the table, the charting … and told them, read out, the position of the planes, and they knew exactly where to … put those on the map. They put little pointers on the map where the planes were. Once when I was there on night duty, an enemy plane was spotted, along the north of Ross-shire* (SLAC, SL/D163/3b).

The Observer Posts established in No 40 Group were as follows:

A.1	Duntulm (Coastguard Watcher Post)	NG 4157 7421
A.2	Tote (Coastguard Watcher Post)	NG 519 585 (approx)
A.3	Portree	NG 472 448
A.4	Uig	NG 393 625
B.1	Red Point (WOU)	NG 724 686 (approx)
B.2	Lochcarron (WOU)	NG 885 399 (approx)
B.3	Canna (WOU)	NG 263 065 (approx)
C.1	Broadford	NG 647 233
C.2	Isleornsay	NG 6959 1260
C.3	Tarscavaig (Coastguard Watcher Post)	NG 584 106 (approx)
C.4	Glenbrittle (Watcher Post)	NG 412 213 (approx)
D.1	Hallistra (Coastguard Watcher Post)	NG 242 594 (approx)
D.2	Dunvegan	NG 247 483
D.3	Fiscavaig (Coastguard Watcher Post)	NG 331 346 (approx)
D.4	Eist (Coastguard Watcher Post)	NG 1302 4824

(ROC Museum, WOU reporting to Portree Centre; Wood, 1992: 142, 334).

Portree Centre was stood down at 5pm on 12 May 1945 along with the rest of the Royal Observer Corps (Wood, 1992: 181).

Prestwick

Unit	FSHQ
Region	South Ayrshire
NGR	NS 3581 2672 (Powbank Mill)
NMRS	Not allocated
In use	January 1941 – 4 April 1941

From January 1941 a Fighter Sector Headquarters, consisting of a skeleton operations room housed in the attic of a water mill on the edge of Prestwick

87 Powbank Mill in 1941, from *A Yank in the RAF* (© 1941 20th Century Studios Inc. All rights reserved).

airfield, was established. Squadron Leader Sir Archibald Hope DFC was Operations Officer, and he was assisted by Squadron Leader WF Blackadder DSO, Squadron Leader Gemmel DFC and Flight Lieutenant Lewin as Controllers (TNA, AIR 28/40). The Station Operations Record Book noted that "the Operations Room, its equipment and communications were primitive, but its mobile VHF and D/F stations, under the Signals Officers, P/Os [Pilot Officers] Willder and Andrewartha operated efficiently" (TNA, AIR 28/40).

On 4 April 1941 operations moved to Rosemount, a large country house some six miles from the airfield. There communications were still in skeleton form, but new lines were being run in daily (TNA, AIR 28/40).

Between 10 and 23 April 1941, Twentieth Century Fox filmed some scenes with No 602 Squadron at Prestwick, including shots of crews scrambling to their Supermarine Spitfires with the recently closed FSHQ at Powbank Mill in the background (TNA, AIR 27/2075).

Reiss

Unit	Sub-Sector Operations Room and Gun Operations Room
Region	Highland
NGR	ND 3325 5458 (Reiss Hall)
NMRS	Not allocated
In use	22 September 1941 – circa 1945

In August 1941 Group Captain GH Ambler, Kirkwall Sector Commander, visited the Sub-Sector Operations Room at Reiss, in advance of its opening. The new Sub-Sector Operations Room at Reiss became operational at 11pm on 22 September 1941, taking over from the Ops Room at Castletown. As one of the Senior Duty Controllers, Pilot Officer JH Emerson took the last watch at Castletown and Flight Lieutenant EHS Tye took the first watch at Reiss (TNA, AIR 28/138). The Operations Room was in the requisitioned Reiss Hall with a local recalling seeing the building as a child, when it was in use by the RAF during the war, with lots of equipment with people sitting at them and a raised platform at one end of the hall where some were sitting at desks looking down at a big table (Madeline Cormack, via Ian Ross, pers comm).

At 10.30am on 15 October 1941 Air Vice Marshal Malcolm Henderson, Air Officer Commanding No 14 (Fighter) Group arrived at Castletown by air from Inverness. He immediately left to visit the Sub-Sector Operations Room at Reiss, accompanied by Wing Commander DM Somerville, the Castletown Station Commander (TNA, AIR 28/138).

It is believed the Sub-Sector Operations Room was co-located with 340 Gun Operations Room, a Class 'B' GOR, which moved to Reiss from Castletown in September 1941 and was operating there on 14 May 1942 (TNA, WO 212/81). It was still operating there in October 1942 (TNA, WO 212/82).

Scapa

Unit	Gun Operations Room
Region	Orkney Islands
NGR	HY 4540 0996 (Bignold Park)
NMRS	HY40NE 41.01
In use	23 February 1940 - spring 1941

Mr EV Adcock was involved in setting up 332 Gun Operations Room, a Class 'B' GOR, for the Scapa Gun Defended Area:

> *My story starts in Sutton Coldfield (part of Warwickshire in those days) in 1939 when in the TA, a signals company. Our main training was on GOR work, though there were hardly any guns available to guard the Birmingham area until well after the war started.*
>
> *At the end of November 1939 three of us were posted to Edinburgh - a long way from home in those days when I was 18. We lingered there a few days until being put on a train, destination unknown. When we arrived in Thurso on a dark, freezing evening, nobody seemed to know where we were until the following morning we were put on the good ship* St Ola en route *to Stromness. Oh dear! It was rough and glad to get ashore on, I believe, 10th December 1939*

> *My first duties were in the Signal Office, in the front room of the Stromness Hotel, just by the quayside. This was, it was understood, whilst the GOR was being prepared at Kirkwall. After a while, some of us moved to the new site, which was being constructed … Our accommodation was awful, food was delivered in dixies from a Post Office Repeater Station a mile or so up the road, prepared by a detachment of the Gordons, cold when it reached us and not fit to eat. We had to, though. The weather was the worst anybody could remember, we lived and slept in wet clothes and beds, washed in cold water in the open, melting snow over our hut stoves to get a drop of hot water for a shave, and the sole toilet facility was a latrine bucket in the field. Illumination was by hurricane oil-lamps … Our days were spent digging cable trenches in frozen ground to establish phone contact with gunsites. I felt lucky when given the job of glazing hut windows, a pretty cushy number - but having no experience of the trade, failed to secure the glass with pins, and they all blew out when the next gale came along. The new GOR was, meanwhile, being built and was eventually put to use. There must have been electricity, either from mains or generator, for it was well lit* (Mr EV Adcock, pers comm).

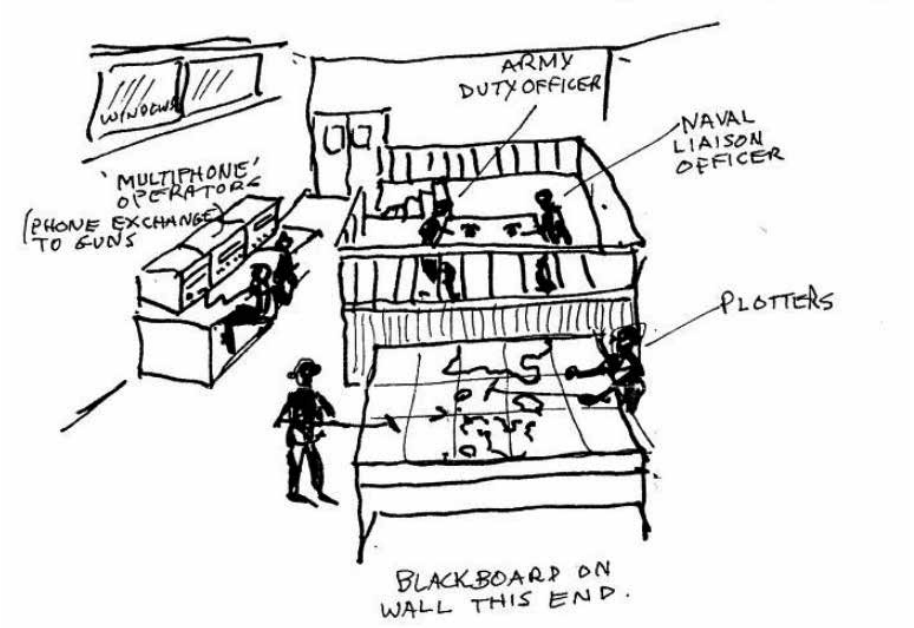
The Scapa Gun Operations Room began operating at 12am on 23 February 1940, with Captain (later Major) John D Whyte as the Gun Control Officer (TNA, WO 166/1234). Information was passed to the GOR from Wick Sector Operations Room (where filtering of information was carried out), Scapa W/T (information from ships, Shetland and Fair Isle), 'E' Buoy, anti-aircraft gun and searchlight positions, naval shore stations and observers in the northern islands (TNA, WO 166/1234).

The GOR was housed in an adapted wooden aircraft hangar on the southern outskirts of the town (TNA, WO 166/1234; HRA, Radar Bulletin, January 1944; Stell, 11; Dr BG Morgan, pers comm). This is believed to have been the Allied Airways hangar from Howe (Stromness) Airfield (Cyril Parkes, pers comm) which certainly was a wooden hangar and was dismantled and moved after the airfield was requisitioned by the Air Ministry (Clegg, 2012: 30).

Mr EV Adcock recalls his work at the GOR:

> *We worked hard - on watch in the ops room, general fatigues in the camp, and mounting a curfew guard at the road junction every night (in a bell-tent) … My stint there lasted just a year, for on 10th December 1940 they put me aboard the* Atlantic Coast *to take me to Lerwick to start a GOR there …*
>
> *It should be noted that in 1940 we had a visit by General Sir Frederick Pile … He asked for the barrage to be fired whilst he was there 'for practice'. As it happened, the* Luftwaffe *ensured that there was no need - we had a real one* (EV Adcock, pers comm).

On 14 April 1940 the General Officer Commanding-in-Chief (GOC-in-C) of Anti-Aircraft Command, Lieutenant General Sir Frederick Pile and the



88 Sketch of Scapa GOR in 1940 (© EV Adcock).

GOC-in-C of 3rd Anti-Aircraft Division, Major General CR Hill, visited the Gun Operations Room along with Brigadier Geoffrey Kemp, OC Orkney and Shetland Defences (TNA, WO 166/1234).

Following the move of Wick Filter Room on 25 September 1940 (TNA, AIR 24/507), and then Wick FSHQ at 4.20pm on 16 October 1940 (TNA, AIR 25/250), both to the site occupied by Scapa GOR, this then became a combined operations block. See under Kirkwall for further details.

Shetland

Unit	Gun Operations Room
Region	Shetland Islands
NGR	HU 4806 4081 (Boy's Hostel)
NMRS	HU44SE 105
In use	1941 - circa 1945

It was proposed in OSDef Operation Order Number 15 dated 10 May 1940 that two Gun Operations Rooms should be established in Shetland on a temporary basis, with field telephone links to all anti-aircraft gun sites. After consultation with the RAF, these were to be located at Graven Camp near RAF Scatsta and at Sumburgh aerodrome (TNA, WO 166/1234). However, in the end only one GOR was built, 322 GOR, a Class 'B' Gun Operations Room, located in the Boys Hostel in Lerwick. It was officially, if incorrectly, named Shetlands. See under Lerwick for further details.

Stornoway

Unit	FSHQ and Sub-Filter Room
Region	Lewis
NGR	NB 4381 3320 (Ops Block, Air Ministry Drawing No 5291/41)
NMRS	NB43SE 60
In use	November 1941 (FSHQ), February 1942 (SFR) – December 1945 (FSHQ), 1945 (SFR)

Wing Commander Wrigley and Squadron Leader Walker arrived at RAF Stornoway from No 14 (Fighter) Group Headquarters on 22 November 1941 to interview the advance party sent from 14 Group for Fighter Operations Duties. The following day, Wing Commander Holden visited Fighter Operations from No 14 Group (TNA, AIR 28/755) indicating that the Fighter Sector Headquarters was operational.

Flying Officer CS Archer arrived at Stornoway from No 14 Group on 24 November 1941 to take charge of the Fighter Operations Filter Room (TNA, AIR 28/755). Stornoway Sub-Filter Room opened in early February 1942 (HRA, No 60 Group RDF Bulletin, February 1942). Borve Castle Chain Home Beam radar station was completed in June 1942 but could not be used because there were no communication facilities. The station became operational during August 1942, passing plots on a temporary line to Stornoway Sub-Filter Room (TNA AIR 26/103).

On 30 November 1942 Stornoway FSHQ was apparently placed on a care and maintenance basis (TNA, AIR 25/250), although it would continue in operation. On 27 May 1943 Tiree Sub-Filter Room closed down, with Stornoway taking over responsibility for filtering information from Ben Hough and Greian Head radar stations (HRA, No 14 Group RDF Bulletin, June 1943).

During much of 1944 a considerable amount of time was spent at Stornoway Sub-Filter Room plotting transatlantic US aircraft. In late April and early May 1944, the sub-filter room was swamped and required more than their usual allocation of numbers to allocate to plots (HRA, HQ 60 Group Radar Bulletin, May 1944). Intense activity during August 1944 culminated on 12 August between 7.30am and 8pm with 4,000 plots told by the tellers in the sub-filter room (HRA, HQ 60 Group Radar Bulletin, August 1944).

At 11.59pm on 29 February 1944, the strength of the FSHQ at Stornoway was seven officers and 86 airmen. It remained approximately this level until 31 May, by which time it had changed to five officers and 93 airmen. By 31 December 1944 the strength had returned to seven officers and 86 airmen but a month later this had reduced to four officers and 79 airmen. By 31 March 1945 it had increased to five officers and 99 airmen and remained at approximately this level until the end of September 1945 when the strength of the FSHQ was seven officers and 94 airmen. On 31 October 1945 the unit strength was back down, to five officers and 79 airmen (TNA, AIR 28/755).

Ian Hill recalls his posting to Stornoway:

My arrival at FSHQ Stornoway was about 10.30pm on Thursday 22nd March 1945, after one of the longest train journeys one could take in Britain, having boarded a train at Redruth, Cornwall, at 5.32pm on Tuesday 20th.

I was a Radio Telephone Operator … My duties alternated between watches on VHF Receivers and the VHF Homer. During the first few weeks I was employed at the former, generally on a three-watch system with 24 hours on and 48 hours off, with the change-over being at 1pm. When on duty one was required to keep the receiver on tune and log all conversations on the particular wavelength. VHF Homer was, as the name implies, for the purpose of helping aircraft back to base if they were not sure of their position. Again, the operator was required to listen out and log all conversations. In both cases, communication with Flying Control was via a field telephone.

In addition to duties at the above locations, we were sometimes called upon to go on R/T stand-by at the Sector all night. This was in case there was a breakdown in land-line communication with the RDF [radar] *stations and information would then be transmitted by R/T on VHF sets.*

Billets for FSHQ personnel were about half a mile from the Sector, along a road with loose surface … Wires were passed over the roofs of the huts (all Nissen) and cemented into the ground to prevent the aforesaid becoming airborne in high winds … If I remember rightly, there were zinc bowls on a table in each hut for the purpose of washing. Water for this purpose was conveyed in a bucket from the sole tap on the site …

Although we were a separate unit, we had to use the amenities on the [aero]drome. Transport was provided from FSHQ to the mess for people going on or coming off duty, otherwise it was a case of walking from the billets for meals. Vehicles allocated for transport were one RAF coach and two 15cwt lorries (Ian Hill, pers comm).

Mr Hill also remembers the recreational facilities available in Stornoway:

The cinema (The Playhouse) was very popular, as in those days pictures were probably the favourite form of entertainment. The programme changed three times a week. The management were also very kind, as on Tuesdays and Thursdays members of the armed forces were admitted at reduced prices.

There were two canteens in the town, one run by the NAAFI situated on the quay alongside north beach, and the other by the YMCA situated in the Square. Both were popular places to visit for refreshment and a chat with the young ladies who served at the counter! Dances were held frequently in the Town Hall, which gave the opportunity of mixing with the local population. Occasionally a dance would be held at the radar station at Broad Bay (Hughes, 2008: 51, 53).

Stornoway FSHQ was disbanded during December 1945 (TNA, AIR 28/755).

Stornoway

Unit	Gun Operations Room
Region	Lewis
NGR	NB 4381 3320 (FSHQ)
NMRS	NB43SE 60
In use	circa 1942 – circa 1945

342 Gun Operations Room, a Class 'B' GOR, opened in Stornoway before 14 May 1942 (TNA, WO 212/81) and was still operating there in October 1942 (TNA, WO 212/82). It is assumed that this GOR was co-located with the FSHQ although it has not been possible to confirm this.

Stranraer

Unit	Gun Operations Room
Region	Dumfries & Galloway
NGR	NX 0728 6043
NMRS	NX06SE 105.01
In use	circa January 1942 – circa 1945

On 26 June 1941 63rd Anti-Aircraft Brigade was informed that the proposed Stranraer GOR and a Heavy Anti-Aircraft Regiment would be under the command of that Brigade (TNA, WO 166/2316). Two days later, on 28 June, Major WE Gill of 12th AA Divisional Signals carried out a reconnaissance with Divisional officers to select a site for a new GOR in the Stranraer area (TNA, WO 166/2215), but the proposed accommodation was found to be inadequate. Instead a proposal to quarter the GOR and HAA Regimental HQ in alternative existing accommodation or in a hutted camp was proposed. Another site reconnaissance was carried out on 24 July by the Brigade Major, Major JR Scott, and Staff Captain, Captain HP McMaster, from 63rd AA Brigade of the HAA site at Stranraer (TNA, WO 166/2316).

63 AA Brigade Operation Instruction No 5 Amendment No 1, issued 13 February 1942, indicates a telephone line between Stranraer GOR and Ayr SOR, suggesting that the GOR was operational by that date and possibly became operational in January 1942 (TNA, WO 166/7420). Stranraer was designated 327 Gun Operations Room and was a Class 'B' GOR (TNA, WO 166/2213, WO 212/81). It was still operating there in October 1942 (TNA, WO 212/82).

Sumburgh

Unit	FSHQ and Sub-Filter Room
Region	Shetland Islands
NGR	HU 3904 1101
NMRS	HU31SE 34.04
In use	29 January 1941 – 17 January 1942

In early December 1940 telephone communication between the Shetland Islands and Kirkwall FSHQ was provided via a submarine cable (HRA, RDF in Northern Scotland and the Islands). Communication between Shetland and Orkney via this cable was cut on 25 January 1941, and between Orkney and the Scottish mainland on 27 January (TNA, AIR 28/917). This resulted in a temporary break in telephone communications between the radar stations in Shetland and Kirkwall Filter Room. As a result, an emergency filter room was opened at Sumburgh on 29 January 1941 to deal with radar information from Shetland. After a few weeks, telephone communication was restored but the temporary filter room remained at Sumburgh (HRA, RDF in Northern Scotland and the Islands).

On 14 July 1941 there were seven raids in the Shetland area, of which Raid 296 was engaged approximately 100 miles east of Sumburgh by two Coastal Command Bristol Blenheims, controlled by Sumburgh FSHQ. The enemy aircraft, a Junkers Ju 88, was claimed as damaged (TNA, AIR 28/917).

Sumburgh Sub-Filter Room operated until 17 January 1942 (Gordon Carle, pers comm) when it began operating from the Boys Hostel in Lerwick (TNA AIR 26/100).

Tain

Unit	FSHQ
Region	Highland
NGR	NH 8122 8098 (Ops Block, Air Ministry Drawing No 5291/41)
NMRS	NH88SW 14.03
In use	8 October 1941 – 30 November 1942

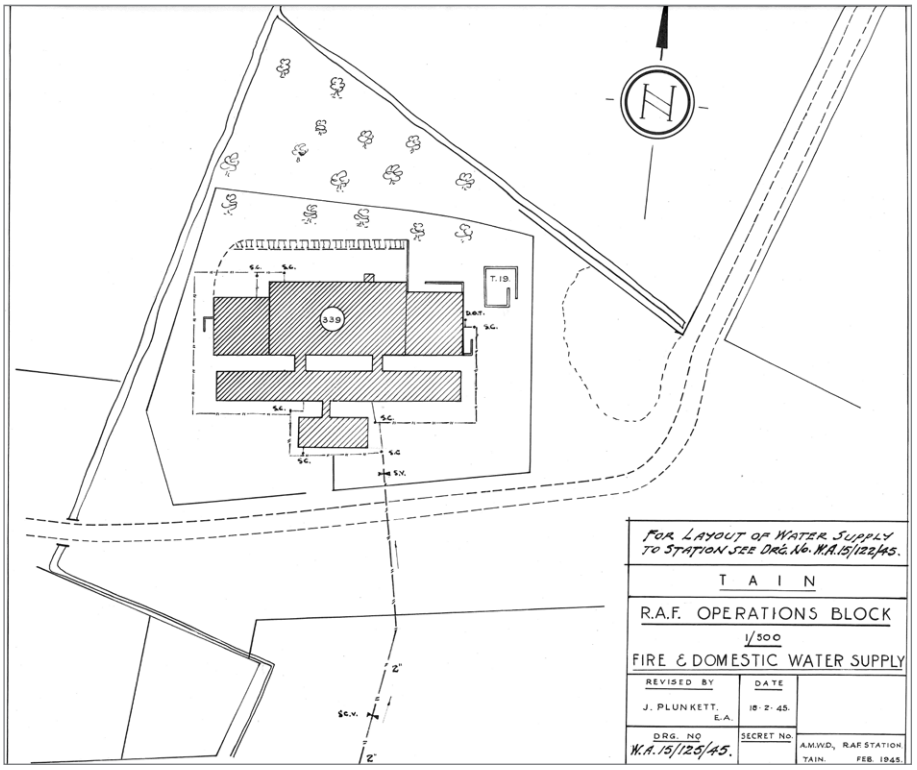
No 18 Wireless Observer Unit arrived at Tain on 16 July 1941 (TNA, AIR 25/250). The WOU Posts within Inverness Observer Group reported to their HQ at Tain, from where information was sent on to Inverness Observer Centre (ROC Museum, WOU reporting to Inverness Centre). See Inverness Observer Centre for further details.

At 9am on 8 October 1941 Tain FSHQ became operational (TNA, AIR 28/917), using an Emergency Operations Room (TNA, AIR 28/804).

Much of the work of the sector was devoted to sector reconnaissance flights and convoy patrols, although there were regular scrambles to intercept unidentified plots. At 9.40am on 20 November 1941 Blue Section of No 123 Squadron were scrambled for patrol and the controller at No 14 Group passed a compliment to the section for the speed with which they took off: Blue 1 was airborne in three minutes and Blue 2 in less than four minutes. Three days later Blue Section were scrambled at 3pm to intercept unidentified Raid X580, but this turned out to be a photographic reconnaissance Spitfire intercepted at 20,000 feet north-west of Inverness (TNA, AIR 27/917, AIR 28/804).

Air Officer Commanding No 14 (Fighter) Group, Air Vice-Marshal Henderson visited Tain and the Emergency Operations Room on 8 January 1942, returning to Inverness the same day. Scrambles continued to be a regular occurrence until the end of April 1942 but were invariably unidentified friendly aircraft and no

89 Supermarine Spitfire Mk IIAs of No 123 Squadron (P7443 XE-K nearest the camera), based at Castletown but under Tain Sector control, probably taken in late 1941 (© Imperial War Museum London CH4180).



90 Tain FSHQ Operations Block site plan (© Historical Radar Archive).

hostile aircraft were ever intercepted under Tain Fighter Sector control (TNA, AIR 28/804).

On 11 June 1942 a great deal of interest was generated by Raid 251, both by the novelty of a genuine hostile aircraft in the sector but also by its remarkable behaviour. The aircraft, a Junkers Ju 88, went down the Minch, cut across the coast just north of Loch Ewe and proceeded at great height along the Moray coast, heading home from Kinnaird Head. It was the most extended reconnaissance in the area for many months, but with no fighters based within Tain Sector, no interception was possible (TNA, AIR 28/804).

On 1 October 1942 the mobile Operations Room left Tain and was returned to the depot at No 1 Maintenance Unit at Kidbrooke in London. A Spitfire from Inverness was controlled by Tain FSHQ on 12 October. The aircraft climbed to 36,000 feet and R/T remained good throughout. On 28 October Blue and Red Sections of No 610 Squadron based at Castletown were controlled from Tain whilst on convoy escort (TNA, AIR 28/804).

Tain Sector remained quiet and not a single raid was plotted on the Sector table during November 1942. It is not surprising therefore that Tain FSHQ was placed on care and maintenance at 12.01am on 1 December 1942 and the Emergency Operations Room closed. It was noted this would make little difference to the activity of the airfield as there had been no fighters based at Tain for several months. Telephone lines to Lybster Fixer station and Oban VHF R/T station were transferred to Peterhead; lines to Findochty and Portmahomack Fixer stations were transferred to Kirkwall via Reiss; lines to Tain homer (the VHF D/F station directing aircraft back to base, which began operating on 13 May 1942) and the various beacon sites were all transferred to the Tain control tower (TNA, AIR 2/7133, AIR 28/804).

Although the FSHQ closed in December 1942, the Coastal Command Development Unit moved to Tain on 15-18 June 1942 and other Coastal squadrons had been operating from the airfield since July 1942 (TNA, AIR 28/804). RAF Tain was formally transferred to Coastal Command on 20 February 1943 (TNA, AIR 25/253). The Operations Block was thereafter used to plan and brief crews flying anti-shipping strike missions from Tain against German shipping along the Norwegian coast (Smith, 1983: 199-201). The transfer of the building for Coastal Command use had originally begun in a small way on 9 July 1942. On that date, HF receivers for use by Coastal Command were installed in the Emergency Operations Room (TNA, AIR 28/804).

Tiree

Unit	FSHQ and Sub-Filter Room
Region	Tiree
NGR	NM 0229 4400 (Ops Block, Air Ministry Drawing No 5291/41)
NMRS	NM04SW 47
In use	April 1942 – 30 November 1942 (FSHQ), 27 May 1943 (SFR)

In early 1941, long-range air attacks on convoys had become an increasing concern for the British Government. Intelligence indicated that the German Air Force was soon to release 200-250 long-range bombers from night bombing of the UK to attacking Atlantic shipping (TNA, CAB 80/26). At the War Cabinet Chiefs of Staff Committee meeting on 27 February 1941 measures for strengthening air defences in the North Western Approaches were discussed. It was agreed that special measures would be taken to complete additional airfields in the Hebrides, including the use of military labour if required (TNA, CAB 79/9). This was combined with extensions to the radar chain (Brown, 2022: 14; Air Ministry, 1950: 152, 553-555).

A Fighter Sector HQ was established at Tiree (Clegg, 2015: 101) to Air Ministry Drawing Number 5291/41 (RAF Museum, Tiree Record Site Plan of Aerodrome Site, Drawing Number TRE.566), as the airfield there was intended to accommodate a fighter squadron alongside a Coastal Command General Reconnaissance squadron (Smith, 2016: 64). The fighter presence was eventually considered unnecessary, but the FSHQ remained in operation (Clegg, 2015: 101).

On 30 November 1942 Tiree FSHQ was placed on a care and maintenance basis (TNA, AIR 25/250). At 10am on 27 May 1943 Tiree Sub-Filter Room closed down, with the radar stations at Ben Hough (Tiree) and Greian Head (Barra) thereafter passing plots to Stornoway Sub-Filter Room (HRA, No 14 Group RDF Bulletin, June 1943).

Turnhouse

Unit	FSHQ
Region	City of Edinburgh
NGR	NT 1605 7397 (RAF Turnhouse SHQ Annexe)
NMRS	Not allocated
In use	February 1939 – 9 September 1939

Unit	FSHQ
Region	City of Edinburgh
NGR	NT 1594 7390 (Ops Block, Air Ministry Drawing No 5000/37)
NMRS	Not allocated
In use	9 September 1939 – January 1942

Unit	FSHQ
Region	City of Edinburgh
NGR	NT 2209 7351 (Kinellan House)
NMRS	NT27SW 170
In use	January 1942 – early 1943

Unit	FSHQ
Region	City of Edinburgh
NGR	NT 2031 7482 (Barnton Quarry, Air Ministry Drawing No 5291/41)

NMRS	NT27SW 114
In use	early 1943 – 1944

Unit	FSHQ
Region	City of Edinburgh
NGR	NT 1594 7390 (Ops Block, Air Ministry Drawing No 5000/37)
NMRS	Not allocated
In use	1944 – 28 April 1946

The original Operations Room at Turnhouse was located in the annexe of the Station Headquarters (Paul Francis, pers comm) and it appears to have been manned for the first time at 10am on 19 February 1939 for a Local Defence Exercise in the Forth and Clyde Defended Areas. The exercise was controlled by the Air Officer Commanding No 12 (Fighter) Group via his Directing Staff at Turnhouse, with the exercise concluding at 1.30pm. Sector Exercises appear to have been carried out most, if not every, Sunday until the outbreak of war in September 1939. The exercise on 1 April 1939 involved Observer Corps Centres at Durham and Galashiels and the manning of the Forth Gun Operations Room. With the formation of No 13 (Fighter) Group, on 1 August 1939 RAF Turnhouse and No 603 Squadron were transferred to the new Group (TNA, AIR 25/219; AIR 27/2073).

On 3 September 1939 RAF Turnhouse Station Headquarters was in the process of peacetime formation when the signal was received from No 13 Group at 11.21am that war had been declared. Group assumed control of operations at 6am on 3 September, but this was resumed by Turnhouse Sector at 8pm. The Sector Controller (and Station Commander) was Wing Commander DM Fleming, with Squadron Leader JM Tomes, Squadron Leader R Johnstone and Squadron Leader EH Stevens as Controllers. Every day, operational control continued to pass to 13 Group around dawn, with control returning to Turnhouse in the evening around dusk. This continued until 5 March 1940 when the state known as 'Sector Control at Night' was abolished (TNA, AIR 28/861).

Included in the Operations Room was a Gun Liaison Officer, who passed information on aircraft movements within the Sector area to the relevant Anti-Aircraft Gun Operations Room. The space occupied by the GLO was designated 203 GOR, a Class 'A' Type 3 Gun Operations Room (TNA, WO 212/81), even though it was not in direct contact with AA gun batteries. The Gun Liaison Officers on 3 September 1939 were Second Lieutenants R Pettie, R Macmillan and J Macmichen, all from 36th AA Brigade (TNA, AIR 28/861).

A new Operations Block at Turnhouse was built to Air Ministry drawing number 5000/37 circa 1938 (Paul Francis, pers comm). Transfer from the SOR in the SHQ annexe to the new Operations Block began at 12.30am on 9 September 1939 and was completed at 1.30am that morning (TNA, AIR 28/861). This Operations Room was described thus:

> *The room itself was akin to a small theatre - approximately 60 feet across with two stories and situated within a heavily reinforced, air-conditioned, self-contained block. The roof consisted of a deep stratum of rubble sandwiched between two layers of concrete. There was no natural light and the doors were bomb-proof. Approximately 40 people staffed the ops room including controllers, plotters, representatives of the Army, Navy, Observer Corps and numerous runners … The Turnhouse controller at the outbreak of war was Squadron Leader Bob Johnstone and from his elevated position he had a clear view of the plotting table and tote board. He was passed weather details, including cloud cover. He also had a direct line to the Headquarters of 13 Group, Fighter Command in Newcastle. As Sector Controller, Johnstone could monitor the progress of an approaching enemy raid and contact the appropriate fighter station and order specific squadrons to intercept* (Ross with Blanche and Simpson, 2003: 45-46).

On 16 October 1939 Turnhouse became the first Fighter Sector in the UK to control a successful interception of enemy aircraft. Spitfires of No 602 (City of Glasgow) and No 603 (City of Edinburgh) Squadrons were ordered to scramble by Turnhouse FSHQ at approximately 2.30pm. Red Section of No 603 Squadron shot down one aircraft east of Dalkeith which crashed into the Firth of Forth near Port Seton, and Blue Section of No 602 Squadron shot down a second aircraft into the Forth (TNA, AIR 27/2073; AIR 27/2079). Although initially believed to be Heinkel 111s, the two aircraft shot down were in fact Junkers Ju88A-1s from I *Gruppe*, *Kampfgeschwader* 30 (Ramsey, 1987: 38), and were the first enemy aircraft shot down over the UK since the First World War.

Turnhouse Sector saw frequent enemy activity throughout the rest of 1939 and the first few months of 1940, achieving a large number of 'kills'. Red Section of No 603 Squadron intercepted and shot down a Heinkel He 111 into the sea seven miles off St Abb's Head on 22 October 1939. On 28 October Red Sections of Nos 602 and 603 Squadrons intercepted and shot down a Heinkel He 111 near Kidlaw in East Lothian (TNA, AIR 28/861). There was more success on 7 December when a formation of seven Heinkel He 111s was intercepted by Nos 72, 602 and 603 Squadrons (TNA, AIR 25/232) and two aircraft were shot down off the Bell Rock Lighthouse (Ramsey, 1987: 57). Further success for the Sector followed on 13 January 1940 when Raid X27, a Heinkel He 111, was shot down 15 miles east of Fifeness by Red Section No 111 Squadron, Red Section No 602 Squadron and an attached Spitfire fitted with 20mm cannons (TNA, AIR 25/232; AIR 28/861). On 19 January a Heinkel He 111 was intercepted by Red Section No 603 Squadron and shot down into the sea 60 miles east of Aberdeen. Blue Section of No 111 Squadron intercepted an enemy bomber two miles south-west of the Isle of May at 12.15pm on 30 January. The section leader opened fire but the bomber was subsequently lost in cloud (TNA, AIR 25/232; Ramsey, 1987: 64). At 11.53am on 9 February Green Section 603 Squadron intercepted three enemy bombers 10 miles east of Arbroath. Only Green Two was able to open fire before the aircraft disappeared into cloud but was subsequently identified as a Junkers Ju 88 which crashed into the sea off Peterhead (TNA,

91 RAF Turnhouse, taken from the north, on 2 May 1940. The FSHQ is the protected building centre right, just behind the row of six huts (© Historical Radar Archive).

92 Supermarine Spitfire Mk Is of No 609 Squadron at Drem, but under Turnhouse Sector control, taken in February or March 1940 (© Imperial War Museum London HU104509).

AIR 25/232; Ramsey, 1987: 69) Soon after, at approximately 12.30pm, a Heinkel was shot down by Red Section 602 Squadron at North Berwick (TNA, AIR 25/232). No 602 Squadron had further success on 22 February when a Heinkel He 111 was shot down, this time at Dowlaw, near St Abb's Head. Another Heinkel was spotted by Red Section 609 Squadron whilst on a convoy patrol five days later, and shot down into the sea, six miles east of St Abb's Head (TNA, AIR 25/232; AIR 28/861). At 2.11pm on 7 March a Heinkel He 111 was intercepted by Red Section 603 Squadron 80 miles east of Carnoustie and shot down into the sea (TNA, AIR 25/232).

On 15 March 1940 No 13 Group reported to HQFC that considerable difficulty was being experienced at Turnhouse with regard to the siting of D/F interception tables. Due to the layout in the Sector Operations Room, it was thought an internal structural alteration would be necessary if the tables were to be fitted in, in a position where the Controller could supervise the work. The main issue was that the Sector map was larger than normal and this, combined with having to find room for a Naval Liaison Officer, meant a lack of space. It was found that with tables of the standard size it was just possible to get them into the Operations Room. However, the gangway between the operations table, plotters and the interception tables had to be reduced to the absolute minimum. It was agreed that the operations table could be reduced by making the southern limit the River Tyne rather than the River Tees as it was previously (TNA, AIR 16/14).

On 31 March 1940 GA Roberts of Stanmore Research Section reported on the Operations Room at Turnhouse:

> *A preliminary study was made of the special features of the operational system at Turnhouse. It appears that this Sector has considerably greater responsibilities than any other Sector and it is considered that the normal Operations Room staff and communications are inadequate for the following reasons:-*
>
> I. *All aircraft are operated from advanced stations:-*
> *Dyce*
> *Montrose*
> *Drem*
> *Grangemouth*
> *There are land-lines to Drem and Grangemouth, but there is only a party line* [shared telephone line] *to Dyce and Montrose, and communication on this line is said to be extremely slow.*
>
> II. *It is not possible to track aircraft from Dyce and Montrose by D/F, and it is believed that it is the usual practice for these aircraft to be operated from these stations on such very scanty information as can be passed over the party line. A certain amount of information is also said to be received from coastguards.*

III. *The liaison teller has lines to:-*
Aberdeen Observer Centre
Dundee Observer Centre
Dunfermline Observer Centre
Galashiels Observer Centre
Glasgow Observer Centre
Usworth Sector
Drone Hill RDF Station
Douglas Wood RDF Station
School Hill RDF Station
which is about twice the normal number, and therefore involves about twice the usual amount of work. In addition to these normal duties, he has to pass:-
a. *RDF plots to all Observer Centres except Glasgow – this is to relieve the Group liaison line of this load.*
b. *Details of all non-operational flying to Observer Centres.*
There is a great deal of this and the Observer Centres insist on having it. It is recommended that the liaison teller should have an assistant.

IV. *Turnhouse, unlike other Sectors, acts as a bureau of non-operational flying. Various organisations request permission to fly and when this has been granted, the liaison teller, Naval Liaison Officer and possibly Gun Liaison Officer have to be informed, in order that they may tell their various organisations. This involves a lot of extra work for Ops B, who should have an assistant.*

V. *A two-way keyboard for Ops B is urgently required, and it is recommended that this station should be treated as Priority 'A' in this matter. It is understood that authority for the provision of these boards was obtained many months ago, but 13 Group Sectors at least are still struggling with the old single-way type. It would help if an additional PBX line were provided, terminated near Ops B in a separate telephone, on which all incoming PBX calls would be made. The existing line could then be reserved for urgent operational requirements and other calls would not interfere with the operation of the keyboard.*

VI. *It is understood that 602 and 609 Squadrons work on the same radio frequency.*

VII. *A D/F Station near Dunbar or St Abb's Head would improve D/F facilities* (TNA, AIR 16/14).

It was recommended by Fighter Command on 4 April 1940 that since neither Ops B nor the Liaison Teller could be expected to keep pace with their workload even under normal conditions, both should be provided with assistants. The assistant to the Liaison Teller could be an Aircraftman but the assistant to Ops B should be a Sergeant. The lack of these posts was causing operational efficiency to be seriously

impaired although it was noted that should Dyce become a Sector Station these posts could be withdrawn (TNA, AIR 16/14).

Circa 1940, Kinellan House at 33 Murrayfield Road in Edinburgh was selected and fitted out as an Emergency Operations Room (Mowbray Pearson, pers comm). During the Battle of Britain, Operations Blocks were attacked at Biggin Hill (in Kent) on 31 August and North Weald (in Essex) on 3 September. During the attack on North Weald the Operations Block (built to Air Ministry drawing number 5000/37) received a direct bomb hit on the roof but survived. Biggin Hill was not so lucky; its Ops Block (built to Air Ministry drawing number 1161/24) also received a direct hit but was put out of action. Following these attacks, many Fighter Sector Operations Rooms were moved into previously prepared Emergency Operations Rooms, usually around two or three miles from the Sector Station (Ramsey, 1980: 65-67, 168-169). In the case of Turnhouse, Kinellan House was just under three miles from the airfield. Kinellan House was designed by R & R Dickson and built in 1846. It was enlarged in 1913 to designs by Sir Robert Lorimer (Gifford, McWilliam and Walker, 1984: 633), commissioned by the owner J Herbert Herdman (Savage, 1980: 176).

On 17 September 1940 Flight Lieutenant HC Page was posted to RAF Turnhouse for the purpose of VHF installation (TNA, AIR 28/861). This suggests that Turnhouse Sector switched to VHF in late September 1940. On 8 March 1941 it was noted that Turnhouse was still using HF as well as VHF for R/T and D/F (TNA, AIR 2/3546).

On 18 April 1941 Acting Flight Lieutenant (later Air Commodore) Ronald 'Ras' Berry was posted as a Fighter Controller to Turnhouse (TNA, AIR 28/861). He was an experienced fighter pilot and Battle of Britain veteran, with 9 aircraft destroyed and 6 shared destroyed, at the time of his posting. He recalled his work as a controller at Turnhouse:

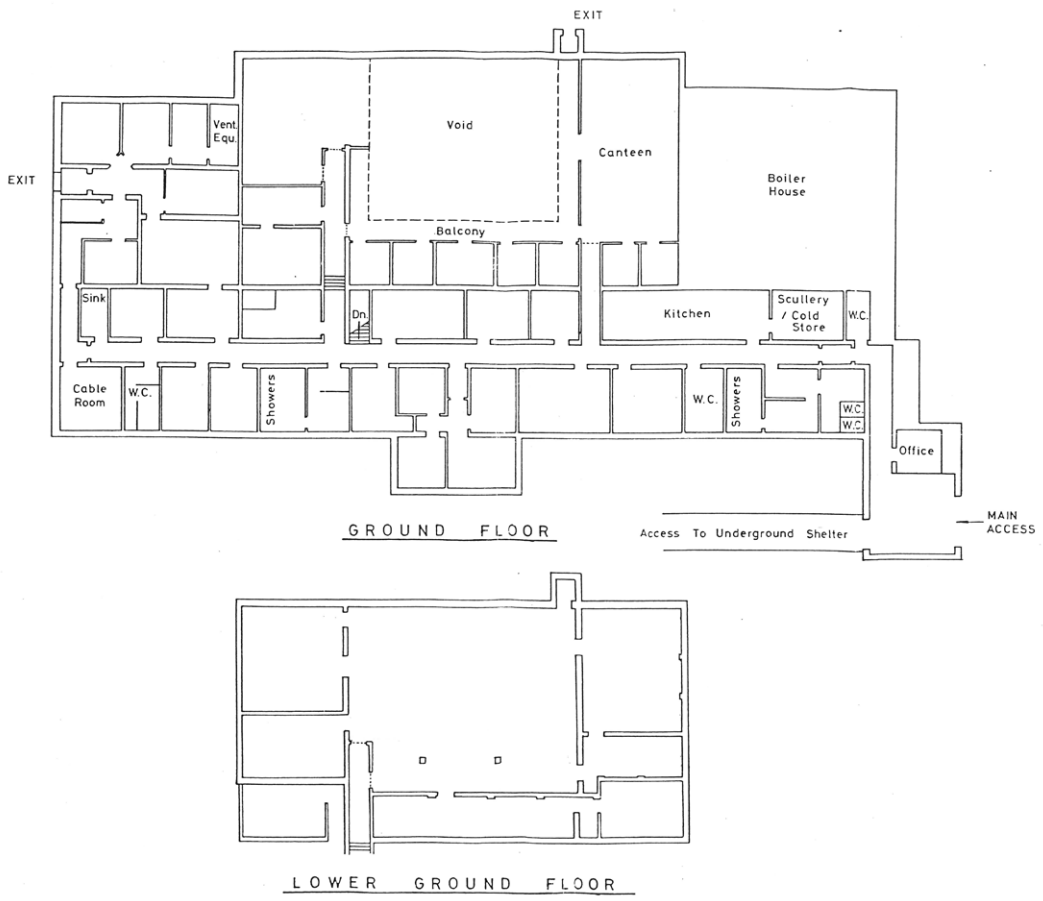
> *They gave me a job as Fighter Controller at Turnhouse … as I'd been at it for 18 months they gave me a rest … You would do a watch, it was on duty 24 hours a day the control room, you'd do a watch spreading out in your week, and you would order interceptions of enemy aircraft and that sort of thing as they cared. A lot of them were investigations when you got a plot coming in, there was minelayers coming in low, there'd be the odd reconnaissance patrol and things like that, and you'd also have convoy patrols to look after the convoys along the east coast, that sort of thing, and you'd liaise with the Army searchlights and a whole lot of balloons over the Forth. You'd just have a general operational job to do.*
>
> *I did control a section of Spitfires out into the North Sea there. They shot down one of these Heinkel minelayers, so I had that excitement at the time …*
>
> *With the facilities we had, you had to be fairly sure where you were going to send your fighters and you had to think very hard about it. Fighter controlling was helped for me because I'd been flying a Spitfire since the beginning of the war and doing interceptions and that sort of thing* (IWM 11475).

On 4 November 1941 the Watch Establishment for the Sector Operations Room at Turnhouse was set by Headquarters Fighter Command as:

Supervisor	1 Sergeant
Deputy Controllers	2 Sergeants
Ops A	1 Aircraftman
Ops B1	1 Aircraftman
ROC Liaison Teller	1 Corporal
Bomber Plotters	2 Aircraftmen
Fighter Plotters	2 Aircraftmen
Triangulator Teller	1 Corporal
Triangulator Setters	3 Aircraftmen
ROC Plotters	9 Aircraftmen (Carlisle, Dunfermline, Galashiels, Ayr, Glasgow, Oban, Dundee, Aberdeen, Durham)
Fighter Table Plotter/Tellers	3 Aircraftmen (Ayr, Dyce, Ouston)
Fighter Table Supervisor	1 Corporal
RDF Plotters	2 Aircraftmen (plotting positions from HQs 13 and 14 Groups)
CHL Plotters	2 Aircraftmen (Anstruther, Cockburnspath)
GCI Plotter	1 Aircraftman (Dirleton)
GCI Liaison	1 Corporal
Sector Fighter Plotter	1 Aircraftman
Messengers	2 Aircraftmen (Aircraft Hands)
NCO in charge	1 Flight Sergeant
NCO Assistant	1 Sergeant
Tracer	1 Corporal
Clerk General Duties	1 Aircraftman (TNA, AIR 2/3546).

Although Turnhouse FSHQ did not move to its Emergency Operations Room in the autumn of 1940, as did many other FSHQs, the FSHQ did eventually move to Kinellan in January 1942. Following this move, a new telephone exchange opened in Kinellan on 31 January 1942, with extension lines available to Squadron Leader Operations, Operations Administration, Intelligence Officer, Meteorological Officer, Cypher Officer, Gun Liaison Officer, Naval Liaison Officer, Signals Traffic Office, Signals Officer, Signals Stores, Controller, and Operations 'B'. Within a month or so, Kinellan was established as a routine run of Mechanical Transport, with a Fordson Bus transporting Operations and Signals personnel to and from Kinellan, Cargilfield (WAAF accommodation) and Turnhouse airfield, making eight journeys each day. A light van was also running all day, transporting Operations officers to and from Kinellan and Turnhouse airfield (TNA, AIR 28/865).

Ethel Hedge was a WAAF Clerk Special Duties at Turnhouse in 1942:

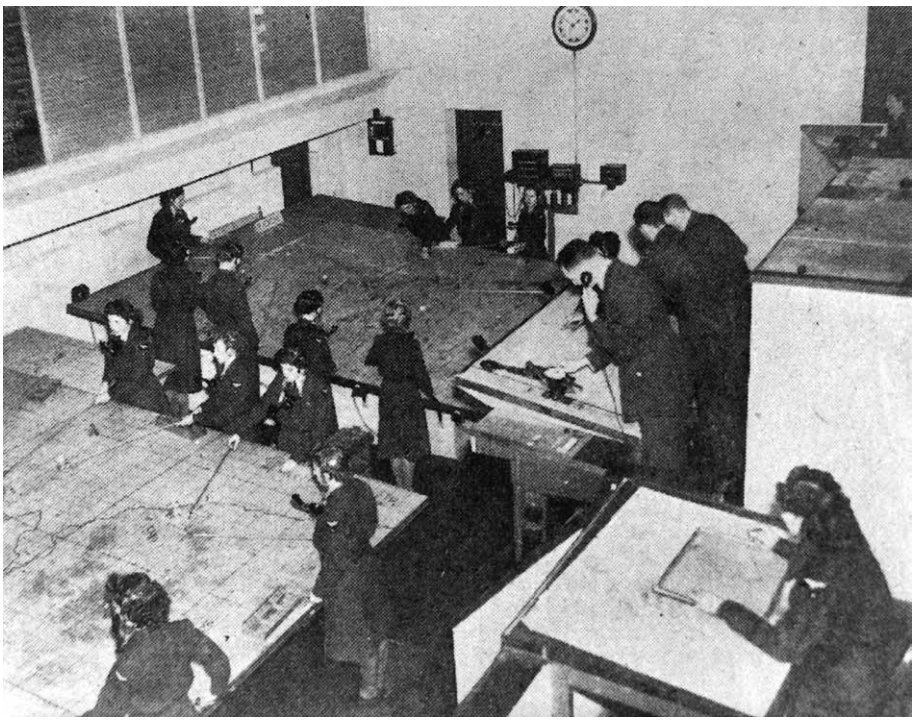


93 Plan of the Operations Block at Barnton Quarry, Air Ministry drawing number 5291/41, drawn in June 1987 and showing access to the underground building dating from 1952 (© Lothian Regional Council).

> *I joined up as a Clerk SD stationed at Turnhouse (Ops Room first on the airport and then at Kinellan Road in Murrayfield), was thoroughly bored pushing things about on the table and used to spend a lot of time studying direction finding etc, etc. After a very short time I was posted to Dirleton* [radar station] (Ethel Russell, pers comm).

During early 1943 Turnhouse FSHQ moved from Kinellan House to a purpose-built Operations Block in Barnton Quarry (Mowbray Pearson, pers comm; TNA, AIR 16/675). This was a standard mid-war Sector Operations Block, built to Air Ministry drawing number 5291/41.

On 15 June 1943 Turnhouse Sector moved from No 13 (Fighter) Group to No 14 (Fighter) Group, but on 15 July 1943 No 14 Group was renumbered as No 13 Group, with headquarters at Inverness (TNA, AIR 28/637).



94 Turnhouse FSHQ at Barnton Quarry, taken in 1948 when in use post-war by a Fighter Control Unit of the Royal Auxiliary Air Force (© The Scotsman).

Squadron Leader HS Linthwaite assumed the duties of Senior Controller from Squadron Leader NJ Riddle on 15 September 1943, the latter having been posted two days earlier (TNA, AIR 28/862).

A new watch system for Clerks, Special Duties, employed in the Sector Operations Room at Barnton Quarry came into effect on 1 March 1944. The new watches were 8.30am to 4.30pm, 4.30pm to 10.30pm and 10.30pm to 8.30am. Improvements had been made to the existing canteen for ops room personnel with meals then available during shifts (TNA, AIR 28/862).

From 28 April 1944 two RAF Police Corporals were permanently employed at the main entrance to the Operations Block at Barnton Quarry. On 18 June 1944, No 1 Edinburgh Home Guard provided a guard of two NCOs and six men at the Operations Block from 8pm to 6am. A system of passwords was arranged between the Home Guard and RAF Turnhouse (TNA, AIR 28/862).

On 2 August 1944 the Meteorological Office moved from Barnton Quarry Operations Block to Turnhouse and was located close to Flying Control on the airfield (TNA, AIR 28/862). It is believed that the FSHQ moved from Barnton Quarry back to Turnhouse airfield soon thereafter.

Peterhead Fixer Table moved from the control tower there to the Sector Operations Room at Turnhouse on 22 September 1945. All fixer stations from

the former Peterhead Sector area were henceforth reporting to Turnhouse SOR (TNA, AIR 28/862).

Three plots from the Royal Observer Corps were received at Turnhouse FSHQ at 3.27pm on 26 December 1944 of a hostile aircraft near Dyce. A Section of Supermarine Spitfires were scrambled from Drem and vectored north, but at 3.30pm the hostile was reported to have landed at Dyce. The hostile, a Messerschmitt Bf 109, had made a belly landing on the grass at Dyce and overturned, sustaining damage. The pilot was unhurt and taken into custody (TNA, AIR 28/862).

On 15 November 1945 Turnhouse Sector was renamed Midlothian Sector (TNA, AIR 28/862), with Turnhouse remaining as Midlothian Sector HQ until disbanded on 28 April 1946 (Sturtivant, 2007: 191). During December 1945, release of personnel meant that the strength of the Sector Operations Room reduced from 90 to approximately 60 operators (TNA, AIR 28/862). On 12 May 1947 the Ministry of Civil Aviation took over the Operations Block for use as the flying control tower (TNA, AIR 28/1138).

Usworth

Unit	FSHQ
Region	Tyne and Wear
NGR	NZ 3392 5878 (Ops Block, Air Ministry Drawing Number 5625/36)
In use	September 1939 – 10 March 1941

Usworth FSHQ became operational in September 1939 (TNA, AIR 28/870). As a result of the German Air Force attack on shipping in the Firth of Forth on 16 October 1939, Usworth Sector despatched 5 patrols, without success (TNA, AIR 25/232).

Before the end of 1939 the area covered by Usworth Sector had changed. The previous Sector area was taken over by Catterick Sector, and Usworth instead covered the area west and north up to Turnhouse Sector, and thus covered southern Scotland and NW England (Collier, 1957: Map 12).

The Sector saw considerable enemy activity on 3 February 1940, with patrolling aircraft vectored to intercept enemy aircraft attacking shipping, despite information from radar and Observer Corps being scanty. Four enemy aircraft were destroyed. Following these actions, at 2.30pm six Supermarine Spitfires from 602 Squadron at Drem were sent to reinforce Usworth Sector (TNA, AIR 28/870).

Further enemy activity was reported the following day, 4 February, on the coast near Berwick and also near Alnwick. A fighter patrol from Acklington failed to find the aircraft and due to poor weather they were forced to fly at low level, making R/T communication and D/F fixing difficult. At 3.05pm on 7 February the reinforcement of the Sector by Spitfires from 602 Squadron ended, and the aircraft returned to Drem (TNA, AIR 28/870).

Foreign transmissions in Dutch, German and English were picked up on 1 March 1940 just off the R/T frequency used by No 152 Squadron (TNA, AIR 28/870), which was operating Supermarine Spitfire Is from Acklington (Halley, 1988: 226). Direction finding by the War Office indicated that the transmissions originated just off Scheveningen in the Netherlands and were not considered hostile. Further R/T messages were picked up from 9.20am on 3 March, partly in English and partly in German, consisting of tuning transmissions making use of days of the week. Although this used the same frequency and call-sign as the signals on 1 March, the source of the transmissions was found by direction finding to be Hanover in Germany. More transmissions were received on 5 March, again on the same frequency, giving tuning messages in English and talking in German (TNA, AIR 28/870).

On 7 March further transmissions were received, this time exactly on the frequency used by No 72 Squadron (TNA, AIR 28/870), also operating Spitfire Is from Acklington (Halley, 1988: 140). Pilots of the squadron were receiving messages on their TR9 radios referring to "orange aircraft," followed by chatter in a foreign language that was not understood, and then reference to "south bound convoy approaching." The transmission was very powerful and completely blocked out R/T from Sector Control. Considerable R/T interference was experienced during the early period of darkness and this greatly hampered communication between FSHQ and aircraft on patrol in the dark, as well as 'fixing' (direction finding) the position of these aircraft. Further foreign R/T transmissions were reported on the Sector Fixer frequency on 9 March, and on 13 March foreign R/T transmissions in German or Dutch were received on a frequency of 5470 kc/s. It appears that this was the last occurrence of these transmissions and no further issues were noted (TNA, AIR 28/870).

On 15 March 1940 No 13 Group reported to HQFC that the D/F interception tables in Usworth Sector Operations Room had not been completed at that time due to a lack of timber to complete the surface of the tables. The map table had to move approximately 6 feet, but this was easily possible without having to make any alterations to the wiring. Between 14 and 21 March one table came into operational use. Eight men were under training as Deputy Controllers, but only one of them had a suitable R/T voice. Women were also being trained (TNA, AIR 16/14).

Raid X14 proceeding north on the coast on 16 April 1940 was originally plotted as a friendly Coastal Command aircraft. When off Coquet Island at 1.16pm this was changed to unidentified. Red Section of No 72 Squadron scrambled at 1.20pm but failed to make contact. Between 1.34pm and 2.17pm Yellow Section of 72 Squadron carried out a sweep from Acklington to St Abb's Head. At 2.07pm X14 was identified and plotted as a friendly fighter (TNA, AIR 28/870).

On 25 May 1940 Usworth Sector, previously designated 'P' Sector became 'R' Sector (TNA, AIR 28/870).

On 31 March 1940 GA Roberts of Stanmore Research Section reported that, on the instructions of No 13 Group, experiments were being carried out at

Usworth Sector Operations Room, with a screen round Ops A, Sector Controller, Gun Liaison Officer and Searchlight Liaison Officer. The screen was 9 feet in height and reached nearly to the ceiling. There was a door at the back and a hatch on each side, one of which was there to enable Ops A to operate the squadron indicator panels and to pass forms to Ops B. The other hatch was to allow the Gun Liaison Officer and Searchlight Liaison Officer to talk to their telephonists. The screen was made of a composition millboard material and was reasonably sound-proof. The experiment seemed satisfactory except that Ops B could not hear what orders were issued by the Controller (TNA, AIR 16/14).

Raid X36 appeared at 4.49am on 31 May 1940 east of the Farne Islands, travelling west at 2,000 feet. It turned north until opposite Forth before turning south-west until 5.31am. Red Section of 72 Squadron took off at 5.01am but at 5.31am X36 was redesignated as friendly and Red Section was ordered to land. The fighters were in the vicinity of X36, which turned south-westerly when they were vectored to 225º. This indicated that the plotting of X36 as friendly was due to confusion with the fighters, the real X36 having been lost (TNA, AIR 28/870).

At 8.02am on 29 June 1940 Yellow Section, No 72 Squadron, took off to intercept Raid X25 which approached the coast between St Abb's Head and Berwick from the north-east, believed engaged on meteorological reconnaissance. The enemy aircraft, a Dornier Do 17, was sighted at 8.38am and engaged and shot down in flames into the sea approximately 100 miles east of the Isle of May (TNA, AIR 28/870).

The night of 19/20 July 1940 was a busy one in Usworth Sector. At 11.55pm on 19 July Raid X16 appeared some 30 miles east of Tynemouth. It approached Blyth from the south-east then headed north and crossed the coast near the Farne Islands, continuing westwards via Peebles towards Prestwick. Plots of a second raid, designated X93, appeared, following it. The two raids passed into Turnhouse Sector and were observed over the Firth of Clyde, most likely engaged in minelaying. The two raids returned on a similar track and at 2.04am on 20 July X16 was over Lindisfarne and X93 was 5 miles south of Greenlaw. At 1.03am Raid X50 made landfall at St Abb's Head and headed west into Turnhouse Sector where the plots faded. It reappeared at 1.35am about 5 miles east of Lockerbie heading east, passing over Rothbury at 1.44am and crossing the coast near Acklington. Raid X10 entered Usworth Sector from Turnhouse Sector at approximately 2.35am heading east 5 miles north of Galashiels. It crossed the coast just north of Alnmouth. All four raids, X16, X93, X50 and X10, made good use of the area north of Acklington and south of the Firth of Forth that had no anti-aircraft guns or searchlights (TNA, AIR 28/870).

The Fighter Sector Headquarters was transferred from Usworth to Ouston, with the changeover in operational control taking place at 2pm on 10 March 1941 (TNA, AIR 28/624). A period of transition in which Ouston replaced Usworth as the Sector Headquarters followed. The various sections gradually transferred from Usworth to Ouston, with the move of the Sector Headquarters completed on 15 March 1941 (TNA, AIR 28/870).

Wick

Unit	FSHQ and Filter Room
Region	Highland
NGR	ND 3656 5151 (North School)
NMRS	ND35SE 223
In use	19 February 1940 – 25 September 1940 (Filter Room), 17 October 1940 (FSHQ)

An Air Ministry decision to establish a Fighter Sector for the air defence of the Orkney Islands was made in the latter part of 1939. Pending the construction of Castletown airfield, it was decided to make temporary provision for two fighter squadrons at the Coastal Command station at Wick. The ultimate intention was to provide a permanent Fighter Sector Station at Castletown as soon as possible after the beginning of March 1940 with two fighter squadrons plus provision for reinforcements of up to seven squadrons at Wick and other airfields still to be constructed (TNA, AIR 28/917).

In December 1939 Group Captain F Fernihough was appointed Sector Commander of Wick Sector and he was posted with the other officers to RAF Wick to form the Operations Room staff. On 7 January 1940 one of these officers, Flight Lieutenant Lott, discussed equipment requirements for the FSHQ with RAF Wick Equipment Officer (TNA, AIR 28/915), and work began in January 1940 to

95 Pilots and Hawker Hurricane Mk I L1822 of No 111 Squadron at dispersal at Wick in April 1940 (with a Lockheed Hudson in the background) (© Imperial War Museum London CH106).

fit out a room in Wick North School to serve as a temporary Operations Room (TNA, AIR 28/917). Air Vice-Marshal Richard Saul, Air Officer Commanding No 13 (Fighter) Group visited Wick FSHQ on 29 January (TNA, AIR 28/915), presumably to check on progress towards becoming operational.

Wick North School was built in 1937, to a design by Hugh Macdonald of Sinclair Macdonald (Beaton, 1996: 35). Although not fully completed, the Sector Operations Room was manned from 19 February 1940 (TNA, AIR 28/917). At 4.15pm on 27 February 1940 Air Vice-Marshal Richard Saul arrived at Wick by air for an inspection of the Fighter Sector, the Hawker Hurricanes of No 43 Squadron having arrived at Wick the previous day and the Hurricanes of No 111 Squadron landed at 11.45am on the day of AVM Saul's visit. The Hurricanes of No 605 Squadron flew to Wick two days later (TNA, AIR 28/915).

It had been decided by Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief of Fighter Command that, due to the remoteness of Wick from other Fighter Sectors, it would operate independently but under the general operational control of No 13 (Fighter) Group (TNA, AIR 28/917). Thus, Wick FSHQ also operated as a filter room, being connected to Netherbutton, Hillhead and Thrumster Chain Home radar stations and, from February 1940, Rosehearty Chain Home Low radar station. At that date Stanmore Filter Room at Fighter Command Headquarters was the only other filter room operating, so Wick was the first filter room in the UK separate from Stanmore. Wick Filter Room also received plots from the Naval Coast Defence U-Boat radar stations at Sumburgh and Fair Isle by W/T. These were the first radar stations to plot by W/T and much experience was gained regarding the advantages and disadvantages of W/T plotting. Also plotting to Wick by W/T was HMS *Curlew*, an anti-aircraft cruiser equipped with air warning radar and stationed in Scapa Flow (HRA, RDF in Northern Scotland and the Islands).

At 12.01 am on 1 March 1940, three squadrons of Hawker Hurricane fighter aircraft (Nos 43, 111 and 605 Squadrons) became operational at RAF Wick for air defence purposes, the Sector having had operational responsibility since 3 January 1940 for Nos 803 and 804 Squadrons, Fleet Air Arm (TNA, AIR 28/917).

Mr S Kennedy was stationed at Wick from November 1939 to November 1942. He recalls:

> *My job at Wick was a Wireless Operator in Station Headquarters Signals and we used the school in the early days of the war as the aerodrome was still in the process of being built.*
>
> *I remember one night I was on duty and the pilot of a German plane had been shot down. He was uninjured and was escorted to the school by two soldiers of the Seaforths to be interrogated by the Intelligence Officer. He was held under guard in one of the classrooms which still had all the desks in position as usual and I managed to pop in and see him. He was a sergeant pilot of the* Luftwaffe *and*

> *spoke very little English, but I did manage to have a few words with him about football as he talked about "Hampden Park," "Scotland v England," "plenty goals," then he showed me a photograph of his wife and children. He seemed quite friendly and not at all arrogant as I had expected* (Primary 7, 1993: 75-76).

Wick FSHQ was visited on 15 March 1940 by Air Chief Marshal Sir Hugh Dowding, AOC-in-C Fighter Command, accompanied by Air Vice-Marshal Richard Saul, Air Officer Commanding No 13 (Fighter) Group. On 28 March, command of Wick Sector was transferred from Group Captain Fernihough to Wing Commander GH Ambler (TNA, AIR 28/917).

A conference was held on 4 April 1940 at OSDef HQ in Stromness Hotel with a party from the Air Ministry to discuss the removal of the SOR from Wick to the Scapa Gun Operations Room at Kirkwall. The following day the Air Ministry party inspected the site for the SOR (TNA, WO 166/1234).

On 8 April 1940 a mass air raid was directed against Scapa Flow, comprising approximately 60 enemy aircraft. At 7.52pm Green Section 43 Squadron shot down an enemy aircraft into the sea six miles east of Copinsay. At 8.50pm Green Section 111 Squadron engaged a single Heinkel 20-30 miles east of Scapa. At 9.10pm Blue Section 43 Squadron attacked two Heinkels over Duncansby Head, one of which crash landed at Wick airfield, the crew taking to a rubber dinghy believing they had ditched in the sea (TNA, AIR 25/232).

On 25 September 1940 Kirkwall Filter Room opened, taking over from Wick Filter Room (TNA, AIR 24/507). Wick FSHQ was transferred from No 13 (Fighter) Group to No 14 (Fighter) Group on 13 October 1940 (TNA, AIR 25/232). At 4.20pm on 16 October 1940 operational control was transferred to the new Kirkwall Sector (TNA AIR 25/250), with two watches from Wick. The remainder of the FSHQ personnel, except one officer and a small party, moved the following day and consequently Fighter Sector Operations ceased to operate at Wick on 17 October 1940 and all accommodation was handed over to Wick Station Headquarters (TNA, AIR 28/915).

PART III

Tracking shipping

In addition to passing aircraft plots to the filter rooms, from late 1939 Chain Home Low radar stations (including Naval CDU) were also passing information on ships and surfaced submarines. For stations in Shetland, Orkney and the north of Scotland, this was via W/T to the destroyer depot ship HMS *Greenwich* at Lyness in Scapa Flow (Naval Shore Radar, HRA).

During 1941 and into 1942 the Army set up a chain of CD/CHL coast watching stations intended primarily for the detection of a potential invasion fleet. The CD/CHL stations in Scotland were all built in the first half of 1942 (Brown, 2022: 85, 139, 246, 251-254), but even before this, by late 1941 the potential value of the chain to both the Army and Navy had been demonstrated. This radar information enabled the Royal Navy:

1. To intercept and destroy hostile shipping.
2. To assist the RAF in their attacks on shipping.
3. To give navigational aid to friendly shipping.
4. To warn friendly shipping of approaching danger.
5. To send aid to ships in distress.
6. To keep an accurate plot of the movements of all shipping.
7. To obtain early warning of raiding or invasion shipping.

A Lieutenant-General, Chief of the General Staff, at General Headquarters, Home Forces, noted in November 1941 that in order to make best use of all the available information, Naval and Army authorities should work closely together, with quick and reliable communication. It was proposed that combined naval and military headquarters be established at the HQs of each of 18 Naval Sub-Commands across the UK. Radar information, obtained from within each sub-command and also information from other coast watching services, would be passed direct to the appropriate naval headquarters, which would then take whatever executive action was decided. The 18 Naval Sub-Commands were:

1. Lerwick
2. Lyness
3. Invergordon
4. Aberdeen
5. Pitreavie
6. Newcastle
7. Immingham (Humber)
8. Yarmouth
9. Harwich
10. Nore
11. Dover
12. Newhaven
13. Portsmouth
14. Portland
15. Dartmouth
16. Plymouth
17. Falmouth
18. Milford Haven (TNA, WO 199/1109).

Later, dedicated Naval Plotting Rooms at Aberdeen, Invergordon, Lerwick, Lyness, Pitreavie and Stornoway all received radar information from Scottish radar stations, as did Belfast NPR to which Kilchiaran plotted from July 1943 until 8 June 1945. Ships were plotted in the NPRs from information passed directly from the radar stations, no filtering of plots taking place (TNA AIR 26/92). Direct landlines were provided from the radar stations and other coast watching services to each Naval Plotting Room (TNA, WO 199/1109).

Arguably the most important NPR in the UK was at Western Approaches HQ at Mount Wise in Plymouth. A huge map of the Atlantic Ocean covered one wall of the NPR, showing the location of ships, convoys and reported U-boats. The latter were represented by white submarine symbols, changed to black once the location of the U-boat was verified (Parkin, 2019: 30-31). On 7 February 1941 Western Approaches HQ moved from Plymouth to protected underground accommodation at Derby House in Liverpool. This brought the NPR closer to the main destination for Atlantic convoys using the Clyde and Mersey (Parkin, 2019:135). As at Plymouth, the Liverpool NPR contained a cork-backed 20-foot high wall map of the Atlantic, with the sea painted dark green and the land masses painted biscuit brown. Similar wall maps were installed at NPRs around the UK, including Belfast (Parkin: 2019: 136-137), Pitreavie and Lyness.

Naval Plotting Rooms covering Scotland

Aberdeen

Unit	Naval Plotting Room
Region	Aberdeen City
NGR	NJ 965 056 (Torry Battery)
NMRS	NJ90NE 22
In use	October 1943 – 26 May 1945

Naval ratings arrived at Rosehearty Chain Home Low radar station on 10 October 1941. The ratings were attached from Aberdeen Naval Base for the purpose of manning the telephone line to the Naval Base and passing information on shipping etc (TNA, AIR 26/100).

Torry Fort was built on the south bank of the River Dee, located and equipped to protect the port and harbour of Aberdeen, It served in a normal close defence role and also as an examination battery. The site was originally acquired by the War Office in March 1858 and in May 1940 two BL 6-inch Mk VII Coast Artillery guns (registered numbers 1328 and 1065) were installed in the battery on CP

96 Torry Battery, taken in 1947 (© Historic Environment Scotland).

Mk II mountings (registered numbers 2032 and 2955). Concrete overhead cover for the emplacements was provided in July 1940 to protect against dive-bombing and landward attack. (TNA, WO 192/257).

A combined Navy and Army Plotting Room was completed and manned at Torry Battery in October 1943 (TNA, WO 192/257). Aberdeen NPR closed at 12pm on 26 May 1945 (TNA, AIR 26/92).

Belfast

Unit	Naval Plotting Room
Region	Belfast
NGR	NW 4582 3473 (Belfast Castle)
In use	circa 1942 – 8 June 1945

Christian Oldham was a Wren officer who served at Belfast NPR from late 1942 until February 1944:

I was appointed to run the plot at Belfast Castle where the Royal Navy had installed their HQ. I arrived there late in 1942 … The plotting room was high in the castle, with a good view of Belfast Lough so that we could see the ships coming and going. The radar plot was in the middle of the room and there was a wall plot of the Western Approaches and the whole Atlantic … Next door to us and connected by a hatch was the cypher room, and all the signals (uncoded) were handed through to us as they came in.

The Commander-in-Chief had moved his operations room from Plymouth to Liverpool, while we in Belfast were kept informed of everything that was happening by signal and teleprinter, so we had an accurate and up-to-date picture for visiting officers.

Meanwhile, we recorded the many ships coming up the Irish Sea and from Liverpool and Glasgow, to assemble for the huge slow convoys or the smaller faster ones which formed up to the north, off the west coast of Scotland, near a rocky outcrop called Rockall. Many of the escort ships, destroyers, corvettes and minesweepers were based at Londonderry, and would chase around the vast array of merchant ships like trial sheepdogs, getting them organised in time to sail. A convoy might have as many as 60 ships with two or three corvettes and perhaps one destroyer in attendance. There would have to be a complete blackout and the whole convoy would have to travel at the speed of its slowest ship, which might be no more than five knots.

There was always a senior officer of the day (also working in watches) and I particularly recall a certain night when one of them, who always slept soundly on the floor under his desk, was absolutely impossible to wake up, and this night there was a real emergency: a ship, coming north, was steering far too close to the

shore. I wanted to send it a warning signal because of its dangerous position and needed his authority to do so. We pulled him out, sat him up, patted his face, even threw water over him, but he slept on. So I sent the signal anyway.

The endless black nights of the Atlantic and the terrible weather loaded the dice towards our enemy. In our Castle plot we moved the shipping on their known course and speed with the greatest anxiety, dreading the first signal which announced a U-boat sighting or attack - worse still, we worried about many of their escorts and crews (Lamb, 2021: 154-156).

The radar station at Kilchiaran in Islay (Brown, 2022: 153) sent surface plots to Belfast NPR from July 1943 until 8 June 1945 (TNA, AIR 26/92).

Invergordon

Unit	Naval Plotting Room
Region	Highland
NGR	NH7097 6844 (NOIC Offices)
NMRS	Not allocated
In use	1942 – circa 1945

A list of Vulnerable Points dated September 1942 includes Invergordon (South Sutor) RDF Plotting Room (TNA, WO 166/6035). This was the Combined Plotting Room, for both Army and Navy, at South Sutor Battery, but was not Invergordon NPR. This was made clear in a letter from WHF Crowe of HQ Royal Artillery at Scottish Command to Major General OM Lund, General Headquarters, Home Forces on 30 September 1942. This noted:

The situation at the moment is that the Navy refuse to have their Plotting Room away from Invergordon … If the Combined Plotting Room was located at Invergordon, the Coast Defence Commander is completely divorced from his Fire Command except by telephone, and is quite out of the picture as far as influencing or controlling later stages of action is concerned …

In my opinion the best solution to the problem is to install an Army Plotting Room close to the FC [Fire Command] *post at South Sutor where a suitable site exists. This Plotting Room can be in 3-line communication with the Naval Plotting Room at Invergordon, and can have a suitable Navy representative working in the Plotting Room in the shape of the Captain or Commander XDO* [Extended Defences Officer]*, who are both at South Sutor. The Artillery Commander would thereby be within a few yards of the FC Post and would get all necessary information by direct line from Invergordon* (TNA, WO 199/1158).

As this letter makes clear, Invergordon NPR was not housed within South Sutor Coast Battery, but rather was in the administration offices at Invergordon Naval Base. Crannoch Hill CD/CHL commenced passing plots to Invergordon Naval

Base on 22 May 1942 (TNA, AIR 26/100), and although no information has been found it is likely that the NPR opened in early 1942.

Invergordon NPR passed plots of all vessels within a radius of approximately 70 miles to the Fire Command Post of Nigg Battery and they were plotted on the plotting table at the battery (TNA, WO 192/246).

Lerwick

Unit	Naval Plotting Room
Region	Shetland Islands
NGR	HU 4759 4157 (Fort Charlotte)
NMRS	HU44SE 3
In use	May 1942 – 12 June 1945

During the Second World War, Fort Charlotte was requisitioned by the Admiralty. Several temporary buildings were erected on the seaward side of the fort, including a two-storey reinforced concrete building. This building was extended northwards in 1942, requiring the removal of the inside face of the parapet wall of the fort (Pringle, Ewart and Ruckley, 121). Lerwick Naval Plotting Room was housed within this building inside Fort Charlotte (Douglas Sinclair, pers comm), most likely in the 1942 extension.

Plots on shipping were received by Lerwick NPR from the naval radar stations at Saxavord, Sumburgh and Fair Isle, the latter only passing plots north of an E-W line passing through the station (TNA, ADM 166/4987).

On 7 May 1942 a telephone connection between the Naval Plot at Lerwick and Sumburgh radar station was installed. Twice daily, a list of expected arrivals and departures to and from Lerwick Harbour was sent to Sumburgh via this line, as were signals regarding Sumburgh Lighthouse. This worked well and as a result, plots on shipping from the radar at Sumburgh were exploited more fully than previously. During the month of May 1942, following the opening of the Naval Plotting Room at Lerwick, shipping plots from the radar stations in Fair Isle were passed throughout the day and night and not merely during darkness and bad visibility (TNA, ADM 166/4987).

During June 1942 a total of 109 plots on ships were received by the NPR from Sumburgh radar station, 104 from Fair Isle and 32 from Saxavord radars. The following month 98 were received from Sumburgh and 113 from Fair Isle (TNA, ADM 166/4987).

Fair Isle radar stations noted in July 1942 that at that time shipping plots were given to Lerwick Naval Plotting Room in self-evident code via services exchange. More detailed information could have been given to the plotting room and a forecast of shipping movements given to Fair Isle radars if a more secure means of communication were established. It was suggested by the Officer Commanding the naval radar stations on Fair Isle that it would be possible to achieve more secure communication by linking the Fair Isle radars to the NPR via Lerwick Filter Room (TNA, ADM 166/4987).

During August 1942 112 plots on surface vessels were received from Fair Isle and these included a track from 12.05am on 15 August moving at between 7 and 8 knots. This was suspected to be a minelaying submarine and a further 28 plots were received over the following four hours. The track was lost at 5.30am at a range of 20 miles from Fair Isle radar. Only 8 plots were received from Saxavord during the month. In September 103 plots were received from Sumburgh, 134 from Fair Isle and 30 from Saxavord. 35 plots were received from Saxavord during October. In November 1942 87 plots were received from Fair Isle radars, but only 75 plots were received from Sumburgh and only 19 from Saxavord. During December 102 plots on surface vessels were received from Fair Isle; 60 plots were received from Sumburgh, but good ranges were achieved by the latter such as 36 miles on a tug and 11 miles on a Motor Torpedo Boat (MTB). 61 plots were received from Saxavord. With the Type 273 radar operational at Sumburgh on 1 January 1943 performance improved immediately: the *Good Shepherd* was followed to 31,000 yards towards Fair Isle, whereas the maximum range achieved by the CHL radar had only been 12,500 yards (note: Type 273 operated on a wavelength of 10cm and was therefore more accurate and had better detection of surface vessels). During January the NPR received 32 plots on shipping from the CHL at Sumburgh and 104 plots from the Type 273, although these were only a small proportion of the actual plots logged. A total of 99 plots were received from Saxavord (TNA, ADM 166/4987).

In February 1943 the NPR received 88 plots from Saxavord and 188 plots from Fair Isle. The Type 273 radar on Fair Isle became operational in February with a greatly improved performance on surface vessels. During March 326 plots were received from Saxavord on 80 ships, of which 4 were unidentified. In April

97 Lerwick Naval Plotting Room, in Fort Charlotte, housed in the concrete structure in the centre right of the photo (© Dennis Coutts).

Fair Isle Type 273 passed 2,619 plots on 388 vessels, but the CHLs only passed 8; 266 plots were received from Saxavord. A total of 462 plots on 104 ships were received from Saxavord in May. During June Fair Isle Type 273 passed 1,964 plots and 30 from the CHLs, with 361 plots received from Saxavord. During July Fair Isle Type 273 passed 2,130 plots on 380 vessels, the CHLs sending no plots as they no longer plotted on tracks obtained by the Type 273 unless they had information which the Type 273 did not; 453 plots were received from Saxavord on 154 ships. During August 1943 Fair Isle Type 273 passed a total of 3,234 plots on 527 vessels and Saxavord passed 261 plots on 96 ships. In September 2,884 plots were passed on 482 vessels by Fair Isle and 456 plots were received from Saxavord on 101 ships. In October 1943 2,582 plots were passed from Fair Isle on a total of 364 vessels, with 518 plots on 103 ships received from Saxavord (TNA, ADM 166/4987).

Fair Isle radar noted in October 1943 that during busy periods it was difficult to pass shipping plots to Lerwick NPR because Lerwick Filter Room was either too busy with aircraft or Fair Isle were so busy with aircraft that the Type 273 radar plotter had to wait for a quiet moment to pass his plots to the filter room from which they were passed to the NPR. When these busy periods occurred aircraft plotting was stopped until the shipping plots had been passed through and then the passing of these plots depended on the filter room (TNA, ADM 166/4987).

A total of 2,449 plots on 346 surface vessels were passed to Lerwick and Lyness from Fair Isle during November 1943 (TNA, ADM 166/4987).

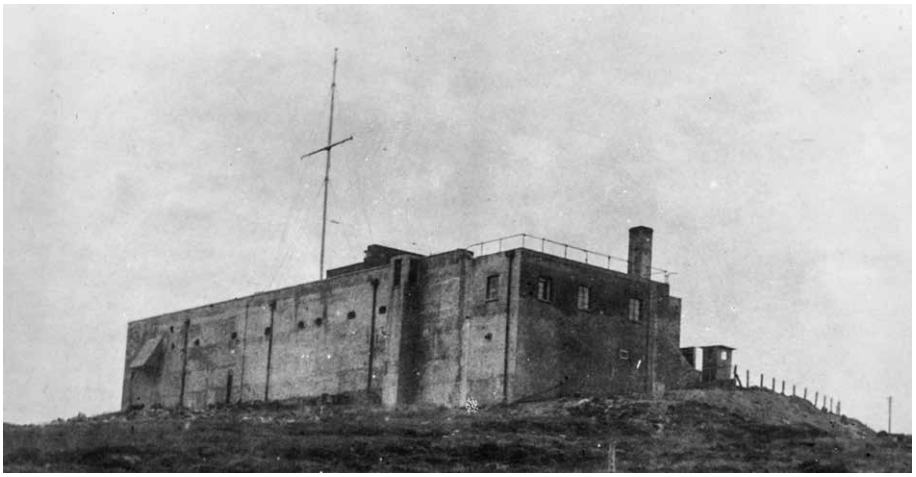
Lyness

Unit	Naval Plotting Room
Region	Orkney Islands
NGR	ND 3111 9507 (ACOS Office, Lyness)
NMRS	Not allocated
In use	circa 1939 – 4 September 1943

Unit	Naval Plotting Room
Region	Orkney Islands
NGR	ND 2940 9446 (Wee Fea)
NMRS	ND29SE 2
In use	4 September 1943 – 19 February 1945

Shipping movements in the Orkney area were tracked by the office of the Admiral Commanding Orkney and Shetland. Originally based onboard HMS *Iron* Duke, when this battleship was bombed on 17 October 1939 and had to be beached, ACOS moved into accommodation ashore at Lyness (TNA, ADM 116/5790). With the construction of naval radar stations at Fair Isle (February and March 1940), South Ronaldsay (October 1940) and Dunnet Head (December 1940) information on hostile as well as friendly shipping was passed via W/T to the destroyer depot ship HMS *Greenwich* at Lyness in Scapa Flow (HRA, Naval Shore Radar) and from there by teleprinter to the NPR in the ACOS Office at Lyness. In February 1941 a W/T station opened at South

98 Admiral Commanding Orkney and Shetland Offices at Head of the Right, Lyness (TNA, ADM 116/5790).



99 The Central Communication Building & Staff Office at Wee Fea, containing the Lyness Naval Plotting Room, photographed on 23 October 1945 (© The National Archives, ADM 116/5790).

Walls, taking over the role of HMS *Greenwich* (TNA, ADM 116/5790). Plots on shipping were received by Lyness NPR from the Naval radar stations at Dunnet Head, South Ronaldsay and Fair Isle, the latter only passing plots south of an E-W line passing through the station. During June and July 1941 Dunnet Head radar station passed information on convoys to Kirkwall SOR (TNA, ADM 166/4987). Plots were also passed from the RAF radar stations at Crustan and Deerness (TNA, ADM 116/4739).

On 5 August 1942 a Type 273 centimetric radar became operational at Dunnet Head. However, the station had no landline to Lyness and instead plots were passed by W/T on a frequency of 2700 kc/s. An average of 35 tracks were passed to Lyness daily during August. By the following month a landline to Lyness had been installed, but the link was bad and variable. On 16 November a Type 86 VHF R/T set was installed at Dunnet Head by telegraphist ratings from Lyness and most satisfactory results were obtained (TNA, ADM 166/4987).

In March 1943 a direct plotting line was installed between the radar stations on Fair Isle and Lyness Naval Plot and shipping plots from these stations were thereafter sent direct by this line (TNA, ADM 166/4987).

On 23 July 1943 the Plotting Officer at Lyness passed his congratulations to the Type 273 radar at Fair Isle on its plotting of a destroyer over the intervening Orkney Islands at a range of 55,000 yards, being finally lost at 60,000 yards (TNA, ADM 166/4987).

The vulnerability to air attack of the wooden hutting occupied by ACOS at Lyness was recognised, and plans were developed for a protected splinter-proof office and communications centre. Construction began in early 1942 by 'B' Company Royal Marine Engineers (Collins, 5-6) and the new blast proof Central Communication Building & Staff Office opened on 4 September 1943 (TNA, ADM 116/5790).

Pitreavie

Unit	Area Combined HQ and Naval Plotting Room
Region	Fife
NGR	NT 1172 8483
NMRS	NT18SW 9.06
In use	late 1940 – 26 May 1945

In February 1937 proposals were submitted by the Commander-in-Chief, Coast of Scotland, to the Admiralty for the provision of a bomb-proof headquarters. The offices of the C-in-C at that time were described as being of flimsy construction and incapable of being made bomb-proof or even splinter-proof. They were also located within 50 yards of oil tanks and would, in the event of a fire in the tanks, have to be abandoned (TNA, ADM 1/9883).

Instructions were issued by the Admiralty in January 1938 that a bomb-proof combined operations room, including communications facilities, should be constructed at Rosyth. In a report produced by the Rear-Admiral and Commanding Officer, Coast of Scotland, in February 1939, it was indicated that this should provide for a fully bomb-proof building of two floors constructed 50 or 60 feet below ground level (TNA, AIR 2/3582).

Authority was issued in a Treasury letter of 7 October 1938 for the purchase of Pitreavie Castle, near to Rosyth Naval Base, and for the construction of a Coastal Command Group Headquarters there, at a cost of £35,000 (TNA, AIR 2/3582). Pitreavie Castle was purchased from the trustees of the estate of the late Henry Beveridge through Macbeth Currie & Company in Dunfermline

(Valuation Rolls, Pitreavie Castle, 1935 & 1940). It was then planned to adapt the Castle for offices for No 18 (Reconnaissance) Group of RAF Coastal Command, with additional timber hutting in the Castle grounds for RAF quarters, and further accommodation in the grounds for Naval offices. The Area Combined Headquarters to be used by the Royal Navy, RAF and British Army was to be housed in the previously proposed two-storey underground bomb-proof building. However, on 10 March 1939 the Secretary of the Admiralty indicated that:

> *These plans are considered to have been prepared to provide for a much more elaborate scale of protection than appears to be necessary. The site at Pitreavie Castle is isolated and not within any danger area, and the Council therefore consider that an operations block with protection only against 25-lb bombs should suffice to meet the requirements. This is the standard type for Royal Air Force Bomber Group Headquarters operations blocks and would be of a design that could be built much more quickly than that proposed by the Commanding Officer, Coast of Scotland* (TNA, AIR 2/3582).

Despite this, at a meeting on 18 April 1939 at the Admiralty it was agreed that although the site was small and difficult to locate from the air, the existence and continuity of Pitreavie was considered vital to the operations of the fleet. This importance was considered sufficient to justify making the operations room proof against 500-lb bombs. It was also agreed that the RAF would be responsible for the construction of the operations room. Chief of the Imperial General Staff, Lord Gort, indicated the importance of Pitreavie in a letter to Air Chief Marshal Sir Cyril Newall, Chief of the Air Staff, on 25 April 1939:

> *From a purely War Office point of view, these Headquarters cannot be considered as 'vital' to the same degree as they are to the Admiralty and Air Ministry. To us they really constitute important intelligence centres from which early warnings of impending attack from seaward are communicated to our defended ports. As you are aware, we are represented by liaison or intelligence officers whose main responsibility is to represent the GOC-in-C or GOC concerned and to get important information through to the coast defences concerned in time to be of use. It would appear, therefore, that the degree of protection provided does not vitally affect us … The chances of a direct hit and the type of bomb likely to be used are, of course, matters for the Air Ministry to appreciate … I think the deciding factor should be the importance which the Admiralty attach to these Headquarters for the control of naval operations in the North Sea and, as I understand this is considerable, I am biased in favour of a large degree of protection being provided* (TNA, AIR 2/3582).

In his reply, Sir Cyril Newall noted:

I suggest that the position of the Navy regarding the Area Combined Headquarters at Pitreavie … is in some respects different from that of the Royal Air Force. The Headquarters at Pitreavie is not only the focal point of all Naval Coast Defence Organisations from the Wash – North about to the Clyde, but is, as you know, the nerve centre upon which all the initial movements of units of the Fleet depend. Moreover, the continuity of function of the Headquarters in war may play an important part in the operations of the Fleet when it has left harbour. We therefore feel that these Headquarters have, from the Naval point of view, a somewhat similar significance to the importance of HQ Fighter Command, Stanmore, to the Fighter Force and ADGB organisation as a whole.

In regard to your points about the Headquarters being difficult to locate and hit from the air, I suggest that if it is not already known that the Headquarters are to be at Pitreavie it will be very shortly. The importance of this objective to the enemy is such that I suggest he would spare no effort to locate and attack it and it would seem that the alternative to making it reasonably bomb-proof would be the provision of a high scale of long range and light AA gun defences with the consequential high capital and recurring costs.

In regard to the question of proof against GP [General Purpose] *or SAP* [Semi Armour Piercing] *500lb bombs, our technical people have informed that once a scheme of tunnelling of this nature is undertaken, the increase in time of construction and additional costs in going deeper to give proof against even 1,000lb bombs are relatively very small.*

For these reasons we would much prefer to continue with the underground proposal at Pitreavie and would like the Headquarters to be proof at least against 500lb GP bombs or, if you consider attack by SAP bombs to be more probable, to go a bit deeper and provide protection against 500lb SAP (TNA, AIR 2/3582).

By 29 October 1939 the approved cost of the Combined Headquarters at Pitreavie had increased to £183,000 in total, with £125,000 for the Operations Block, £16,000 for RAF accommodation, £8,000 for Naval living and messing accommodation, £22,500 for Naval administration offices and £11,500 for external services and contingencies. Work had started on the underground Operations Block before the end of 1939 with completion of both the Ops Block and surface offices and accommodation due in July 1940 (TNA, AIR 2/3582).

C-in-C Rosyth noted on 18 March 1940 that the following numbers of naval personnel would be employed at Pitreavie:

Officers	59	
Officers (WRNS)	30	
Ratings	57	
Rating (WRNS)	81	
Civilian employees	24	(TNA, AIR 2/3582).

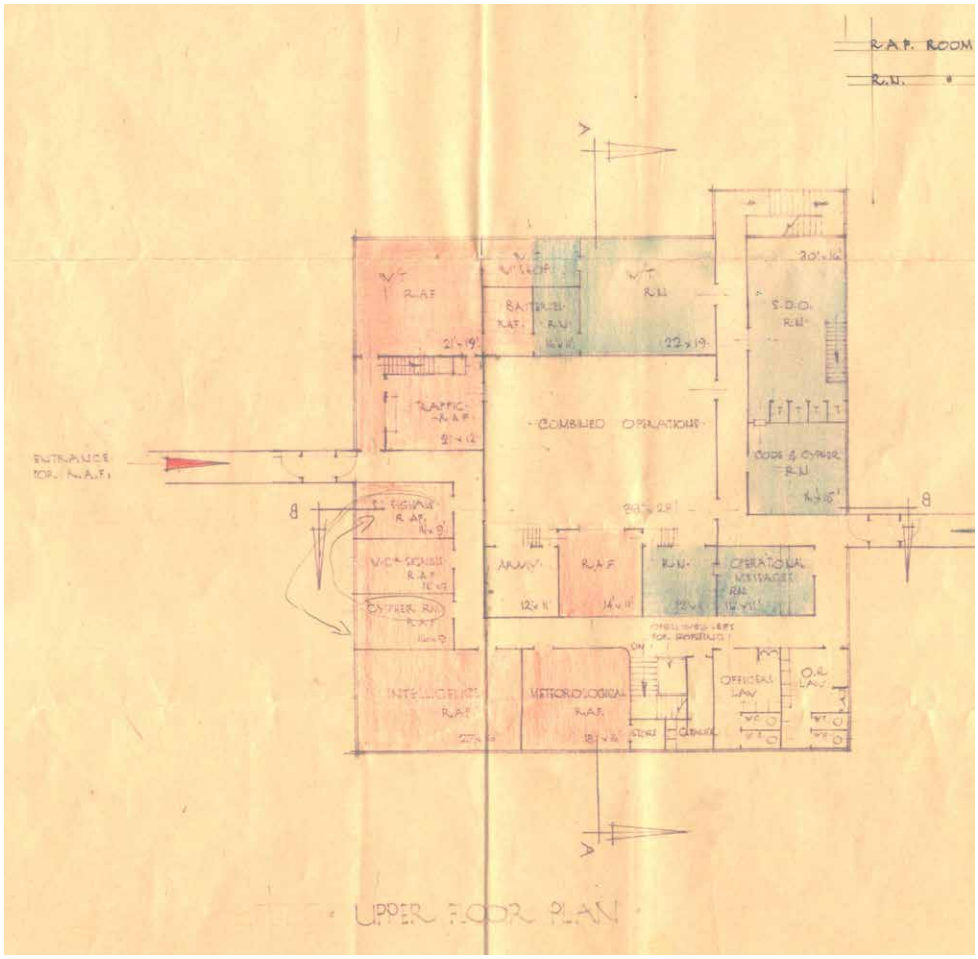
The Area Combined Headquarters opened in late 1940 (Air Ministry, 1958: 86), with two separate entrances: one for RAF personnel and one for Naval. It was noted on 27 May 1941 that, after several months of experience in the underground Operations Block it was found necessary to provide an additional brick hut for 16 Wrens (TNA, AIR 2/3582).

During February 1942 the main event of note within the area of Rosyth Command was the transit of major German Naval vessels, *Scharnhorst, Gneisenau* and *Prinz* Eugen through the Command on their way to the Trondheim area during 21-22 February (TNA, ADM 199/646).

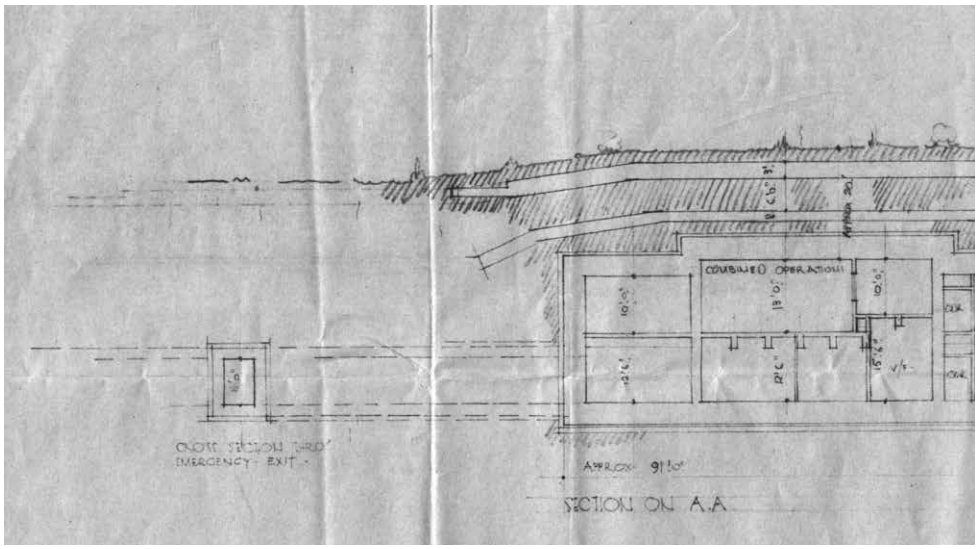
Due to poor weather during August 1944 Pitreavie NPR made greater use than usual of radar plots. Coasters and fishing vessels which strayed from the mine-swept channel and proceeded to the 'declared mine area' were closely watched. Lamberton Moor radar station plotted a vessel to 76,000 yards on 3 August 1944 and later the same day obtained a visual on a fully illuminated hospital ship. Three days later, on 6 August, Lamberton Moor tracked an aircraft on target practice 5,000 yards from the coast which was then seen to crash in the sea. Naval units being plotted in the swept channel turned and approached to within 1,000 yards of the rocky coast and then made their way back to the swept channel. They had picked up the aircraft dinghy and successfully rescued the crew (HRA, HQ 60 Group Radar Bulletin, August 1944).

Ian Hay, who was commissioned by the Post Office to write a history of its wartime work, visited Pitreavie during the late war period:

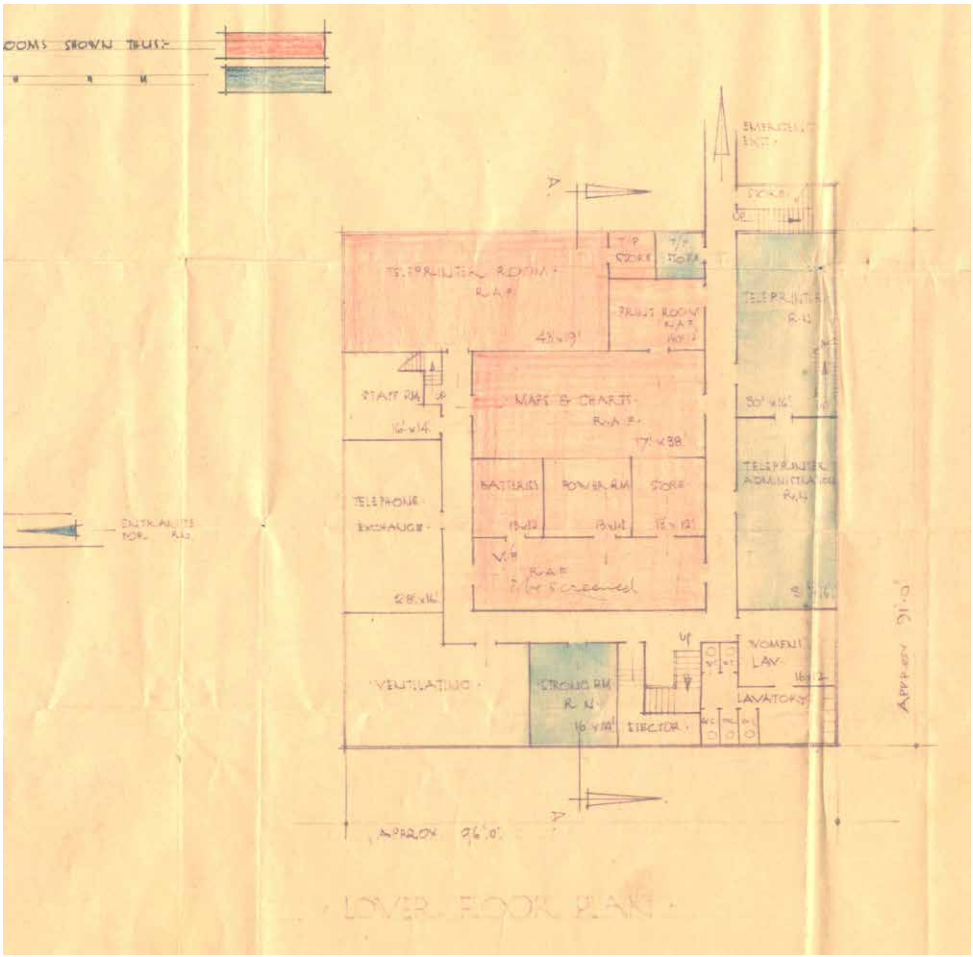
> *It is controlled by the two Services jointly … The whole of the equipment, except in the Wireless Room, is furnished and maintained by the Post Office, with a Post Office liaison officer attached to the strength.*
>
> *The largest and most impressive cell in this underground hive is the Operations Room, a brightly lit hall along one side of which is displayed a vast map of the North Sea … Down in the corner of the map is a chalked notice which says:- Situation at 11.00 hours.*
>
> *A WAAF has just climbed a step-ladder which is leaning against the north of Scotland, and is sticking little aeroplane silhouettes on to a patch of ocean just north-east of Shetland. When she has finished, the pattern forms a rough square. We turn for enlightenment to the Signals Officer. "The purpose of this map," he explains, "is to give those two Controlling Officers" – he indicates a Naval Commander and an RAF Wing Commander enthroned on high above a sea of desks and telephones – "an immediate and complete visualisation of the operational situation in this Control at any given moment. They don't have to read reports or listen to the telephone: all that is done for them by those blokes there" – he indicates the busy telephonists – "and the information they pass out is reproduced in pictorial form by the appropriate Wren or WAAF upon that map. That enables the Controlling Officers to take the necessary action in the shortest possible time."*

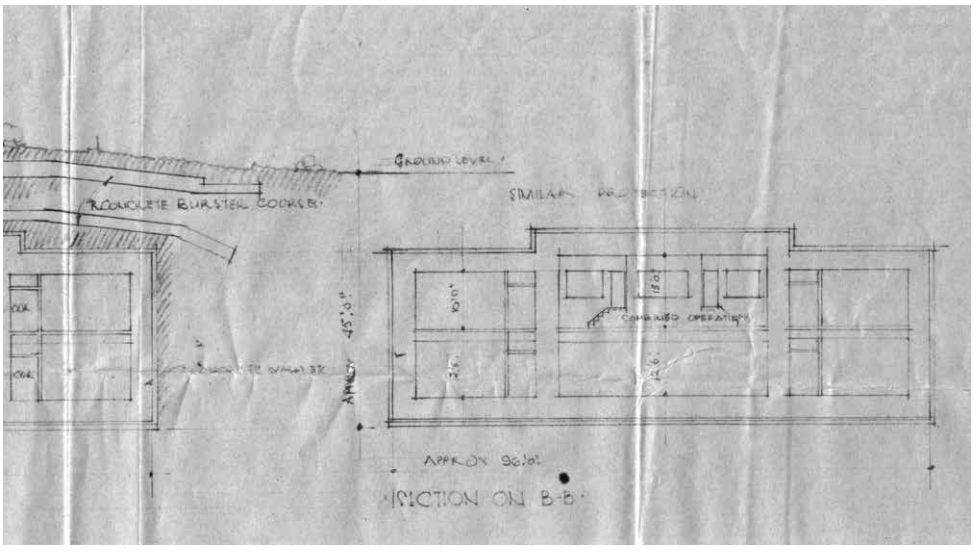


100 Plans of both floors of Area Combined Headquarters, Pitreavie (TNA, AIR 2/3582).



101 Sectional views of Area Combined Headquarters, Pitreavie (TNA, AIR 2/3582).


TELEPRINTER ROOM
R.A.F.
45'x19'
TRUNK ROOM
R.A.F.
MAPS & CHARTS
R.A.F.
17'x38'
STAFF RM.
TELEPHONE EXCHANGE
BATTERIES
POWER RM.
STORE
R.A.F.
VENTILATING
CIRCUIT RM.
R.A.F.
DIRECTOR
WOMEN'S LAV.
LAVATORY
TELEPRINTER ADMINISTRATION
R.A.F.
APPROX 91'0"
APPROX 96'0"
LOWER FLOOR PLAN


GROUND LEVEL
REINFORCED CONCRETE
SIMILAR PROJECTION
COMBINED OPERATIONS
APPROX 45'0"
APPROX 96'0"
SECTION ON B-B

102 Pitreavie Naval Plotting Room (© Imperial War Museum London A 23514).

> *"That little square of silhouettes up off the Shetlands represents an RAF reconnaissance patrol trying to locate a U-boat. As soon as it does so we shall receive a wireless message here, and then the Naval Controller will order out a surface force to do the job, or else the RAF officer will send over a covey of bombers; perhaps both. The one thing that matters is speed, both in communication and action."*
>
> *And so it goes on. Telephone, teleprinter and wireless messages – orders, queries, situation reports, meteorological reports – pour in from hour to hour, or rather from moment to moment, either for the information of the Centre itself or for distribution elsewhere* (Hay, 1946, 64-65).

Pitreavie NPR closed at 12pm on 26 May 1945 (TNA, AIR 26/92).

Stornoway

Unit	Naval Plotting Room
Region	Lewis
NGR	NB 4200 3317 (Lews Castle)
NMRS	NB43SW 49
In use	date unknown – June 1943

On 1 February 1943 the CD No 1 Mk V radar at Kendrom in Skye became operational. Plots of shipping movements were passed in code by the R/T link to Stornoway Filter Room and from there to Stornoway NPR.

Stornoway NPR closed down in June 1943 and consequently the CD No 1 Mk V radar at Kendrom was put on care and maintenance. The CD No 1 Mk V radar at Eorodale in Lewis only became operational at the beginning of June and arrangements were made for it to pass plots to Lyness NPR (TNA, AIR 26/92).

Unfortunately, no further information has been found regarding Stornoway NPR and even the exact location is unknown. It is assumed it was located in Lews Castle, which was used by the Royal Navy during the Second World War, but it has not been possible to confirm this.

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Index

A

Aberdeen (see also Gun Operations Rooms, Royal Observer Corps Centres) 88, 105, 107, 108, 109, 110, 111, 149, 220, 236, 254, 255
Aberlemno (see also Royal Observer Corps Posts) 139
Achnasheen 90
Adcock, EV 192-193, 225-226, 227
aircraft
  Arado Ar 234 29
  Armstrong Whitworth Whitley 111, 141-142, 146, 181
  Avro 504C 33
  Boeing B-17 Flying Fortress 81
  Boulton Paul Defiant 113-114, 164, 165, 216
  Bristol Beaufighter 115, 219
  Bristol Blenheim 37, 231
  de Havilland Hornet Moth 216
  Dornier Do 17 246
  Dornier Do 215 159, 164
  Dornier Do 217 217
  Gloster Gladiator 37
  Hawker Hind 37
  Hawker Hurricane 106, 115, 216, 247, 248
  Heinkel He 111 110, 113-114, 149, 157, 216, 219, 236, 238, 240, 249
  Heinkel He 115 110
  Junkers Ju 86P 219
  Junkers Ju 88 49, 110, 114, 115, 145, 149, 151, 194, 211, 216, 217, 219, 231, 233, 236
  Junkers Ju 188 110
  Lockheed Hudson 247
  Messerschmitt Bf 109 110, 244
  Messerschmitt Bf 110 114, 159, 164, 216
  Miles Master 181
  Supermarine Spitfire 37, 78, 106, 113, 114, 149, 151, 216, 219, 224, 231, 232, 233, 236, 237, 240, 244, 245
  Vickers Wellington 111, 141-142, 146, 181
  'Weather Willie' meteorological reconnaissance aircraft 219
  Westland Lysander 216
  Zeppelin L14 33
  Zeppelin L22 33
airfields (see also Fighter Sector Headquarters)
  Abbotsinch 36, 37
  Acklington 115, 216, 244, 245, 246
  Ayr 101, 113, 115, 116
  Banff 111, 141, 146, 181
  Benbecula 48
  Castletown 41, 134, 232, 233, 247
  Charterhall 81, 83, 86
  Dalcross 177

Drem 79, 99, 216, 237, 238, 244
Dyce 41, 101, 110, 111, 142, 146, 147, 149, 181, 238, 240, 244
East Fortune 33, 86
Elgin 150
Evanton 168
Hatston 41, 186
Howe (Stromness) 183, 226
Kinloss 111, 141, 146, 181, 182, 195
Leuchars 74, 75, 76, 99, 111, 142, 146, 181
Lossiemouth 111, 141-142, 146, 181, 182, 195
Montrose 41, 80, 150, 219, 238
Peterhead 99, 101, 111, 142, 146, 181, 218, 243
Prestwick 79, 119, 246
Scatsta 86, 227
Skeabrae 41, 83. 101
Stornoway 101, 219
Tealing 85
Tiree 81, 101
Twatt 185
Wick 80, 88, 101, 111, 141, 146, 181, 183, 247, 248
Ambler, Group Captain GH 132, 225, 249
Andrewartha, Pilot Officer 224
Andrews, Air Vice-Marshal John 113
Anti-Aircraft Defence Commander 49, 57, 137, 153, 168, 182
Anti-Aircraft Operations Room (see Gun Operations Rooms)
Arbroath (see also Royal OIbserver Corps Posts) 236
Archer, Flying Officer CS 228
Archibald, J 108
Arran 79
ATS 195
Avison, Lieutenant RA 139

B

Bailey, Flight Lieutenant 219
Balerno (see also Royal Observer Corps Posts) 217
balloon barrage 57, 80, 240
Barkett, FL 81
Barnton Quarry (see Fighter Sector Headquarters Turnhouse)
Barra 49, 120, 234
Battle of Britain 29, 63, 240
Belfast Castle (see Naval Plotting Rooms)
Belfast Lough 256
Benbecula (see also airfield, Fighter Sector Headquarters, filter rooms) 90
Bennett, Peigi 221, 223
Bernhard of the Netherlands, HRH Prince 150
Berry, Acting Flight Lieutenant Ronald 'Ras' 240
Berwick-upon-Tweed 216, 244, 246
Biggs, Flight Lieutenant 174
Blackadder, Squadron Leader WF, DSO 224
Blackwell, Captain W 137, 168
Blackwood, Major Robert Cecil, MC 146, 157, 159
Bonnytown Moor 164
Boswell, Flight Lieutenant 174
Boyle, DAJ 214
Breese, Squadron Commander GF, DSC 144
Bressay 193, 194
Bridge of Weir (see also Royal Observer Corps Posts) 219, 220
British Army units
3 AA Division 106, 112, 134, 135, 168, 182, 191, 195, 207, 209, 227
8 AA Group 106, 137
12 AA Division 136, 230
36 AA Brigade 105, 134, 151, 168, 191, 235
42 AA Brigade 135, 155
51 AA Brigade 155
63 AA Brigade 115, 230
94 AA Regiment 105
100 AA Regiment 139

101 AA Regiment 105
113 AA Regiment 195
155 AA Regiment 139
228 AA Battery 105
232 AA Battery 112
291 AA Battery 195
292 AA Battery 191
297 AA Battery 134, 168, 182
'A' Company, 5th Battalion, Queen's Own Cameron Highlanders 134
Anti-Aircraft Command 30, 89, 137, 150, 151, 153, 168, 226
General Headquarters Home Forces 253, 257
Orkney and Shetland Defences (OSDef) 227, 249
Royal Artillery 257
Scottish Command 57, 257
Brown, Sergeant 114
Burns, Corporal T 134

C

Cambuslang 90, 95
Campbeltown 90
Cant, Thomas, MBE 119
Cape Wrath 179, 208
Carmichael-Anstruther, Sir Windham 108, 111, 167
Campbell, Private Thomas 134
Carnoustie (see also Royal Observer Corps Posts) 238
Catto, Alison 175
Chignell, Squadron Leader RA 149
Chirnside (see also Royal Observer Corps Posts) 33
Clarke, Joan 61-63, 122-123, 126
Clova (see also Royal Observer Corps Posts) 139
Clyde, River 35, 48, 79, 80, 112, 150, 164, 178, 235, 246, 254, 264
Clydebank 113
Coast Artillery
Nigg Battery 258
South Sutor 257
Torry Battery, Aberdeen (see Naval Plotting Rooms)
Coastguard Watcher Posts 52-53
Black Dog 109
Duntulm 223
Eist 223
Fiscavaig 223
Hallistra 223
Tarscavaig 223
Tote 223
Coats, J & P 160-162
Cousins, William H 144
Cox, Flight Sub Lieutenant 33
Crerar, Group Captain F 149
Crimp, Flight Lieutenant 219
Cromarty Firth 48
Crowe, WHF 257

D

Davie, R 71, 220
Dee, River 255
Defence Teleprinter Network 94-95
Central Signals Centre, Leighton Buzzard 94
Glasgow Centre 95
Glasgow No 2 Centre, Cambuslang 90, 95
North-West Central Switching Centre, Blackbrook 95
South-West Central Switching Centre, Hawthorn 95
Dickens, Flight Lieutenant 174
Dickenson, JR 159
Dixon, Sergeant 174
Donald, Douglas A 221
Donald, Major Graham 115, 163
Douglas, Sir William Sholto 80, 150
Dowding, Air Chief Marshal Sir Hugh 34, 106, 117, 123, 143, 155, 156, 160, 178-179, 208,248, 249
Drumossie Hotel (see Royal Air Force Fighter Groups 13 and 14)

Duguid, Squadron Leader 106
Dumfries (see also Royal Observer Corps Posts) 115
Dunbar (see also Royal Observer Corps Posts) 239

E

Eaglesham Police Station 114
East Lothian 29, 157, 236
Echt (see also Royal Observer Corps Posts) 107
Edinburgh 33, 35, 45, 57, 143, 151, 155, 160, 204, 217, 220, 225, 240, 243
Edzell (see also Royal Observer Corps Posts) 139
Eltringham, Joe 204
Emerson, Pilot Officer JH 134, 225
English Channel 36, 48
Esau, June 127

F

Fair Isle (see also radar stations) 86
Farne Islands 216, 217, 246
Fernihough, Group Captain F 247, 249
FIDO 91
Fighter Sector Headquarters
- Andreas 116
- Ayr 47, 48, 49, 50-51, 80, 85, 86, 95, 112-116, 230, 241
- Ballyhalbert 47
- Benbecula 48, 49, 95, 120-121
- Biggin Hill 34, 126, 240
- Catterick 37, 38, 39, 40, 47, 94, 197, 207, 217, 244
- Church Fenton 37, 38, 39, 40, 94, 197
- Debden 126
- Dyce 40, 41, 42-43, 49, 79, 85, 105, 110, 147-150, 218, 219, 240, 241
- Hornchurch 34, 126
- Kenley 126
- Kirkwall 41, 45, 47, 48, 49, 52-53, 54, 55, 56, 79, 80, 85, 86, 91, 101, 176, 182-191, 219, 221, 225, 231, 233, 249, 261
- Lerwick 47, 49, 52-53, 54, 55, 56, 86, 88, 91, 176, 184, 191-195
- Midlothian 49, 244
- North Weald 34, 126, 240
- Northolt 126
- Oban 48, 207
- Orkney 49, 191
- Ouston 47, 48, 50-51, 79, 86, 115, 116, 207, 215-217, 241, 246
- Peterhead 47, 48, 49, 50-51, 52-53, 54, 71, 80, 85, 95, 150, 176, 186, 218-221, 233, 244
- Prestwick 48, 80, 112, 223-224
- Stornoway 47, 48-49, 52-53, 85, 95, 120, 176, 228-230
- Sumburgh 230-231
- Tain 47, 48, 52-53, 80, 85, 95, 231-233
- Tangmere 126
- Tiree 47, 48-49, 52-53, 85, 95, 233-234
- Turnhouse 36, 37, 38, 39, 40, 41, 42-43, 47, 49, 50-51, 52-53, 54, 55, 56, 57, 78, 79, 80, 85, 86, 94, 99, 101, 116, 131, 174, 176, 197, 217, 221, 234-244, 246
- Usworth 37, 38, 39, 40, 42-43, 48, 94, 197, 215, 239, 244-246
- Wick 37, 40, 41, 42-43, 58, 134, 183, 197, 226, 227, 247-249
- Sub-Sector Operations Rooms
  - Benbecula 49, 120-121
  - Castletown 134, 225
  - Reiss 52-53, 95, 224-225

filter rooms
- Bawdsey 34, 35, 122
- Benbecula 120
- Drone Hill 35
- Inverness 52-53, 91, 93, 96, 120, 172-173, 175-176, 177, 181, 183, 186, 190, 191, 194

Kirkwall 41, 44, 52-53, 99, 171, 182-183, 186, 188-189, 190-191, 194, 231, 249
Lerwick 44, 52-53, 91, 191, 193-194, 231, 258, 260
Newcastle 50-51, 196, 204-205, 207
Portsmouth 41
Preston (North Western Filter Room) 41
Stanmore (Fighter Command Headquarters) 35, 36, 37, 41, 44, 65, 94, 121-129, 205, 248, 264
Stornoway 91, 96, 120, 228, 234, 269
Sumburgh 44, 186, 193, 230-231
Tiree 52-53, 91, 120, 186, 228, 233-234
Wick 37, 41, 58, 183, 227, 247-249
Filterer 62, 66, 67, 68, 71, 184
Fixer stations (see Very High Frequency Direction Finding stations)
Fleet Air Arm units
No 803 Squadron 248
No 804 Squadron 41, 248
Fleming, Wing Commander DM 235
Flying Control Liaison 73, 75
Fort Charlotte, Lerwick (see Naval Plotting Rooms)
Forth, River (see also British Army units) 29, 35, 143, 144, 145, 151, 155, 156, 157, 160, 178, 235, 236, 240, 244, 246
France 48
Fraser-Mackenzie, John OA, MBE 162, 181
Fraserburgh 109, 110, 149

G

Gairloch 90
Gemmel, Squadron Leader, DFC 224
General Post Office (GPO) 79, 80, 91, 94, 95, 161, 204, 208, 214
German Air Force (Luftwaffe) 29, 48, 109, 116, 177, 211, 226, 234, 244, 248-249
Units
Jagdgeschwader 77 110
Kampfgeschwader 26 110
Kampfgeschwader 30 151, 236
Nachtjagdgeschwader 3 110
German Navy ships
Gneisenau 265
Prinz Eugen 265
Scharnhorst 265
U-boat 49, 81, 254, 257, 268
Gill, Major WE 230
Glasgow (see also Royal Observer Corps Centres and Posts) 48, 79, 80, 113, 114, 115, 135, 164, 215, 216, 217, 256
Goodchild, Norman JH 140, 141
Gort, Lord 263
Graham, Colonel FRW 130, 131, 132, 134
Gray, AW 179
Gun Defended Area 49, 57, 112, 135, 136, 138, 139, 142, 153, 154, 155, 167, 168, 191, 208, 216, 225
Gun Liaison Officer 113, 150, 174, 183, 204, 215, 219, 235, 239, 241, 246
Gun Operations Rooms 49, 57-59
302 Gun Operations Room, Invergordon 52-53, 57, 58, 59, 167-168
322 Gun Operations Room, Shetland 52-53, 57, 58, 59, 191-194, 227
326 Gun Operations Room, Ardeer 57, 58, 59, 112
327 Gun Operations Room, Stranraer 57, 58, 59, 230
332 Gun Operations Room, Scapa 52-53, 57, 58, 59, 182-190, 192, 225-227, 249
336 Gun Operations Room, Loch Ewe 52-53, 57, 58, 59, 195
341 Gun Operations Room, Dundee 50-51, 57, 58, 59, 139, 154
342 Gun Operations Room, Stornoway 52-53, 57, 58, 59, 230
343 Gun Operations Room, Aberdeen 52-53, 57, 58, 59, 105-106

403 Gun Operations Room,
Forth 50-51, 57, 58, 59, 139, 150-154, 235
Sub-Gun Operations Room, Dunfermline 50-51, 59, 142-143, 153
Sub-Gun Operations Room, Ingliston 50-51, 59, 153, 167
404 Gun Operations Room,
Clyde 50-51, 57, 58, 59, 112, 120, 134-138, 168, 182
'A' Sub-Gun Operations Room, Dumbarton 59, 135, 138-139
'B' Sub-Gun Operations Room, Bearsden 50-51, 59, 119-120, 135, 139
'C' Sub-Gun Operations Room, Coatbridge 50-51, 59, 120, 135, 138
'D' Sub-Gun Operations Room, Thorntonhall 136, 137
'E' Sub-Gun Operations Room, Johnstone 50-51, 59, 136, 168, 182
'F' Sub-Gun Operations Room, Inverkip 50-51, 57, 58, 59, 135, 136, 139, 168
507 Gun Operations Room,
Lossiemouth 52-53, 57, 58, 59, 195
508 Gun Operations Room,
Kinloss 52-53, 57, 58, 59, 182
Gun Operations Room, Oban 52-53, 57, 58, 59, 207-208
Sub-Gun Operations Room,
Castletown 57, 59, 134, 225
Sub-Gun Operations Room, Fort William 52-53, 59, 154-155
Sub-Gun Operations Room, Kyle of Lochalsh 52-53, 57, 58, 59, 191
Sub-Gun Operations Room,
Reiss 52-53, 57, 58, 59, 224-225

H

Hamilton, Duke of 114, 164, 165
Hanover 245
Harris 49
Hartley, J 167
Hatcher, Group Captain 218
Hawkhill Farm (see Ardeer Gun Operations Room)
Hay, Ian 265, 268
Hedge, Ethel 241-242
Heggie, Captain WC 139
Henderson, Air Vice-Marshal Malcolm 149, 174, 225, 231
Herma Ness 194
Hess, Rudolf 115, 158, 163-166, 216
High Frequency Direction Finding 77-79
Chandler-Adcock 74, 78
Kilrenny 79
Marconi DFG.12 78
Methven 79
Turnhouse 78, 240
Hill, Major-General CR 227
Hill, Ian 228-229
Hodgkinson, Lieutenant A 194
Holden, Wing Commander 228
Home Guard 164, 243
Homer stations (see Very High Frequency Direction Finding stations)
Hone, Squadron Leader John A 196
Hone Flight Duration Indicator 196-197
Hope, Squadron Leader Sir Archibald, DFC 224
Horn, Alfred, Hauptmann (see Rudolf Hess)
Hounsell, Major HA 191, 208
Hughes, Squadron Leader 219
Humber, River 216, 254
Hunter, Douglas H 181

I

Innes & Grieve 33
Inverallochy (see also Royal Observer Corps Posts) 110
Invergordon (see Naval Plotting Rooms)
Inverness (see also filter rooms, Royal Air Force Fighter Groups 13 and 14, Royal Observer Corps Centres and Posts) 90, 169, 175, 177, 178, 225, 231, 233
Ireland 48
Irish Sea 48, 256
Islay 79, 80, 90, 257
Isle of Wight 126

J

Jackson, Captain Charles d'Orville Pilkington 139, 154
Johnstone, Squadron Leader AVR 'Sandy' 112-113, 147-148
Johnstone, Squadron Leader Robert 'Bob' 235, 236

K

Kay, Sir James Reid 118
Kemp, Brigadier Geoffrey C 227
Kennedy, Colonel John 117, 119, 160
Kennedy, S 248-249
Kidson, Mabel 71, 220
Kilmarnock (see also Royal Observer Corps Posts) 114, 115
Kinnaird Head 233
Kirkcudbright (see also Royal Observer Corps Posts) 115, 116, 117
Kirkwall (see also Fighter Sector Headquarters; filter rooms, Medium Frequency Direction Finding) 186, 187
Knight, Flight Lieutenant 219
Kyle of Lochalsh (see also Gun Operations Rooms) 90, 195, 207

L

Lamb, Captain GH 106
Lamberton 33
Lanark 156, 160, 216
Landau, Acting Flight Lieutenant Rom 170-171, 197-199
Laurence, Sergeant 113-114
Lees, Thomas, MBE 157, 158-159
Leith 33
Lennoxtown 114
Lerwick (see also Fighter Sector Headquarters, Gun Operations Rooms) 191, 192, 193, 194, 226, 254, 258
Lewin, Flight Lieutenant 224
Lewis 49, 90, 91, 269
Lews Castle, Stornoway (see Naval Plotting Rooms)
Ley Smith, GE 111
lighthouses
    Ardnamurchan 212
    Bell Rock 236
    Out Skerries 193
    Sumburgh Head 258
Linthwaite, Squadron Leader HS 243
lochs
    Loch Eil 211
    Loch Ewe 195, 233
    Loch Ness 181
    Loch Slapin 90
Lochgilphead (see also Royal Observer Corps Posts) 90
Loch Ness Monster 181
Lott, Flight Lieutenant 247
Lund, OM 257

M

MacAllister, CA 208
Macdonald, Flora Murchison, BEM 221
McHarg, Alex 118
McKellar, Archie 147
Mackintosh, Lieutenant-Colonel JA 168
MacLean, Squadron Leader Hector 113, 114

McMaster, Captain HP 230
Macmichen, Second Lieutenant J 235
Macmillan, Second Lieutenant R 235
Macpherson, Brigadier AD 168
Marconi Wireless Telegraph Company 74, 78
Medium Frequency Direction Finding 73, 74-77
Andover 75
Belfast 75
Carlisle 75
Inverness 75, 76
Kirkwall 75
Leuchars 74, 75, 76
Marconi DFG.10 74
Renfrew 75
Sealand 75
Stornoway 75
Sumburgh 75, 77
Wick 75
Melvaig (see also Very High Frequency Direction Finding stations) 90
Miller, JM 45
Minch 91, 233
Ministry of Information 151
Moore, Joy 175-176
Moray Firth 29, 177, 233
Morgan, BG 183, 219
Motor Vessels
Good Shepherd 259
Moul, Flight Sergeant J 219
Movement Liaison Organisation 31, 58, 73-74, 184
Movement Liaison Section 73-74, 75, 91, 127, 175, 176, 177, 190
Muir, Aircraftman Second Class J 134
Mull 49, 90, 212
Mull of Galloway 115
Munich 164
Munich Crisis 36
Murray, GDK 105

N

Naval Plotting Rooms 30, 31, 254, 255-269
Aberdeen 254, 255-256
Belfast 254, 256-257
Invergordon 254, 257-258
Lerwick 254, 258-260
Liverpool (Derby House) 254, 256
Lyness 254, 260-262, 269
Pitreavie 254, 262-268
Plymouth (Mount Wise) 254
Stornoway 254, 269
New Aberdour 110
Newall, Sir Cyril 263-264
Newcastle-upon-Tyne (see also filter rooms, Royal Air Force Groups No 13 (Fighter) Group) 33, 114, 196, 254
North Berwick (see also Royal Observer Corps Posts) 238
North British Aluminium Company Limited 209, 211
North Channel 48, 80
North Sea 29, 33, 36, 240, 263, 265
Northern Ireland 75, 117
Norwich 34

O

Oban (see also airfields, Fighter Sector Headquarters, Gun Operations Rooms, Observer Centres) 90, 91, 191, 195, 207, 211, 233
Observer Centres (see Royal Observer Corps)
Observer Corps (see Royal Observer Corps)
Old Inverlochy Castle 210, 211
Oldham, Christian 256-257
Orfordness 33
Orkney Islands 30, 37, 45, 80, 83, 91, 184, 185, 187, 190, 204, 231, 247, 253, 260, 262
Ovenstone, Reginald R 140

P

Page, Flight Lieutenant HC 240
Pattison, RS 111
PBX 63, 74, 91, 239
PMBX 1A 91
Pearl Harbour 29
Peebles (see also Royal Observer Corps Posts) 246
Peirse, Air Vice-Marshal Richard 34-35, 117, 178
Peterhead (see also airfields, Fighter Sector Headquarters) 109, 149, 236
Pettie, Second Lieutenant R 235
Philip, Lieutenant-Colonel GH 168, 182
Pile, Lieutenant-General Sir Frederick 226
Pitreavie (see Naval Plotting Rooms)
Plotter 61-63, 64, 67, 71, 72, 91, 99, 115, 116, 122-127, 129, 145-146, 175-176, 184, 185, 186, 193, 194, 196, 197, 199, 205, 214, 217, 218, 219, 236, 238, 241, 260
Pollock, James D, VC 118
Polson, George 88
Portal, Air Vice-Marshal Charles 160
Porteous, Squadron Leader 174
Portsmouth (see also filter rooms) 33, 254
Pringle, Brigadier 130, 132

R

radar & radio equipment (see also High Frequency Direction Finding, Medium Frequency Direction Finding, Very High Frequency Direction Finding)
Anti-Aircraft/Ground Control of Interception (AA/GCI) 137, 153
AA No 5 Mk 1 137, 153
Airborne Interception (AI) 114
CD No 1 Mk V 269
Chain Home (CH) 34, 41, 64, 66, 67, 69, 99, 127, 175, 248
Chain Home Beam 228
Chain Home Low (CHL) 31, 64, 66, 248, 253, 255
Coast Defence/Chain Home Low (CD/CHL) 31, 253, 257
Coast Defence U-boat 31, 248, 253
Ground Control of Interception (GCI) 99, 116, 137, 153, 154, 184, 217, 219, 241
Identification Friend or Foe (IFF) 63, 74, 127, 129, 137, 176
Broad IFF 69, 71
Narrow/Normal IFF 69, 71
Naval Type 273 259, 260, 262
R1084 97
T1154 96
TR9 77, 78, 99, 245
TR9D 77, 78, 99, 100
TR1133 78
TR1143 44
Wireless Set No 36 137
radar stations
Anstruther 241
Bawdsey 33, 34
Ben Hough 49, 228, 234
Borve Castle 120, 228
Broad Bay 229
Canewdon 34
Carsaig 49
Clett 49
Cockburnspath 241
Cocklaw 52-53, 218, 219
Crannoch Hill 257
Cresswell 217
Crustan 184, 261
Deerness 184, 261
Dirleton 50-51, 241, 242
Doonies Hill 218
Douglas Wood 239
Dover 34
Drone Hill 35, 36, 239
Dunkirk 34
Dunnet Head 184, 260, 261, 262
East Kilbride 50-51, 137
Eorodale 49, 96, 97, 269

Fair Isle 184, 193-194, 226, 248, 258-260, 261, 262
Forth 50-51, 153
Fullarton 50-51
Genoch 116
Great Bromley 34
Greian Head 49, 120, 228, 234
Hillhead 41, 248
Islivig 49
Kendrom 49, 269
Kilchiaran 254, 257
Lamberton Moor 265
Netherbutton 37, 41, 126, 248
Northstead 50-51, 217
Northtown 184
Point of Stoer 49
Poling 61
Ravenscar 35
Rodel Park 49
Rosehearty 218, 248, 255
Russland 52-53
St Quivox 116
Sango 49, 99
Saxavord 258, 259, 260
Schoolhill 239
South Ronaldsay 184, 260, 261
Sumburgh 248, 258, 259
Thrumster 248
Ventnor 61, 126
Watsness 49
West Beckham 35
Radio Telephony (R/T) 77, 78, 79, 81, 89, 98, 99-101, 120, 135, 150, 187, 206, 229, 233, 240, 244, 245, 262, 269
Guard frequencies 99, 101
Command Guard 99
Group Guard 99
World Guard 99, 101
Forward R/T Stations 99
Cockburnspath 99
Drem 99
Gallows Hill 101
Leuchars 99
Peterhead 99
Tain 99
VHF 78-79, 98, 99-101, 150, 224, 229, 233, 240
Type 86 VHF 262
Rainsford Hannay, Colonel F 118
Ranish 90
Rathbone, Lieutenant-Colonel R 191, 208
Rathlin Island 79
Richards, Flight Lieutenant GH 191
Riddle, Squadron Leader NJ 243
Roberts, GA 238, 245
Robertson, Lieutenant-Colonel, Angus, MC 144
Rockall 256
Rosemount House (see Ayr Fighter Sector Headquarters)
Ross, Robert Peel 45, 160, 222
Rowlands, CJ 132, 134
Royal Air Force Commands
Air Defence of Great Britain 122, 161, 264
Bomber Command 74, 75, 94, 95, 122
Bomber Command HQ, Uxbridge 94, 122
Coastal Command 31, 48, 63, 68, 74, 75, 81, 94, 101, 120, 126, 147, 174, 199, 219, 231, 233, 234, 245, 247, 262-263
Coastal Command HQ, Lee-on-Solent 94
Coastal Command HQ, Northwood 94
Fighter Command Headquarters 34, 42-43, 50-51, 52-53, 58, 89, 121-129, 218, 248
Inland Area 122
Royal Air Force Groups
No 9 (Fighter) Group 41, 44, 217
No 10 (Fighter) Group 41, 44, 95
No 11 (Fighter) Group 34, 44, 94, 126, 129
No 12 (Fighter) Group 36, 44, 94, 197, 204, 205, 207, 217, 235
No 13 (Fighter) Group 36, 37, 38-40, 42-43, 44, 45, 47, 49, 50-51, 54-56,

85, 94, 113, 116, 131, 149, 150, 174-177, 196-207, 217, 219, 235, 236, 238, 239, 242, 245, 248, 249
No 14 (Fighter) Group 41, 44, 45, 47, 50-51, 52-53, 93, 149, 150, 169-174, 182, 183, 184, 195, 207, 214, 218, 225, 228, 231, 241, 242, 249
No 18 (Reconnaissance) Group 263
No 26 (Signals) Group 88, 129
No 82 (Fighter) Group 205
Royal Air Force miscellaneous units
No 1 Maintenance Unit, Kidbrooke 233
No 14 Maintenance Unit, Carlisle 132
No 18 Wireless Observer Unit 45, 50-51, 52-53, 181, 184, 211, 212, 213, 221, 231
Posts
Aikerness 184
Ardnamurchan 210, 212
Black Braes 184
Braemore 180
Canna 221, 223
Cleat 184
Coll 211, 212, 213
Colonsay 211, 212
Culkein 180
Deerness (see Twee Ber)
Dervaig 211
Elphin 180
Forsinard 180
Green Table 180
Grim Ness 184
Hollandstoun 184
Iona 211, 212
Kinbrace 180
Lairg 180
Langdale Lodge 180
Lochcarron 221, 223
Melvaig 180
North Ronaldsay (see Hollandstoun)
Oldshore 180
Opinan 180
Overscaig 180
Red Point 221, 223
Reiff 180
Rispond 180
Sanday 184
Scourie 180
South Ronaldsay (see Grim Ness)
Strathmore Lodge 180
Stronsay (see Cleat)
Tiree 211, 212
Tobermory 210, 212
Tongue 180
Twee Ber 184
West Mainland, Orkney (see Black Braes)
Westray (see Aikerness)
Type 1 meteorological office 171, 196
Type 4 meteorological office 174, 196
Y Service 186
Royal Air Force Squadrons
No 3 Squadron 41
No 41 Squadron 37
No 43 Squadron 115, 248
No 64 Squadron 37
No 66 Squadron 78
No 72 Squadron 37, 115, 216, 245, 246
No 111 Squadron 41, 236, 247, 248, 249
No 123 Squadron 231, 232
No 125 Squadron 219
No 132 Squadron 187
No 141 Squadron 41, 113, 216
No 152 Squadron 245
No 232 Squadron 41, 150
No 317 Squadron 216
No 416 Squadron 219
No 488 Squadron 115
No 504 Squadron 41
No 598 Squadron 106
No 602 Squadron 37, 112, 113, 147, 224, 236, 238, 239, 244
No 603 Squadron 37, 149, 235, 236, 238
No 605 Squadron 248

No 607 Squadron 37
No 609 Squadron 37, 237, 238, 239
No 610 Squadron 233
Royal Air Force Wings
No 70 (Signals) Wing 194
No 105 (Combined Operations) Wing 116
Royal Navy bases
Aberdeen 105, 254, 255
Invergordon 48, 168, 254, 257
Rosyth 33, 35, 105, 262, 264, 265
Lyness 253, 254, 260
Scapa Flow 29, 37, 41, 176, 186, 187, 248, 249, 253, 260
South Walls W/T station 260-261
Royal Navy ships
HMS *Curlew* 248
HMS *Greenwich* 253, 260, 261
HMS *Iron Duke* 260
Royal Observer Corps
Areas
North-Western 48
Northern 45, 48
Scottish 45, 48, 144, 159, 160-162, 164, 222
Centres
Aberdeen 37, 45, 46, 50-51, 52-53, 106-111, 141, 146, 160, 181, 218, 239, 241
Ayr 45, 46, 48, 50-51, 116-119, 217, 241
Carlisle 37, 45, 46, 50-51, 116, 119, 129-134, 205, 217, 241
Dundee 37, 45, 46, 50-51, 52-53, 111, 116, 139-142, 146, 160, 181, 205, 218, 239, 241
Dunfermline 37, 45, 46, 48, 50-51, 52-53, 111, 116, 141, 143-147, 155-156, 159, 160, 181, 205, 218, 239, 241
Durham 37, 50-51, 205, 217, 235, 241
Galashiels 37, 45, 46, 50-51, 116, 144, 155-159, 160, 205, 217, 235, 239, 241
Glasgow 37, 45, 46, 48, 50-51, 52-53, 108, 115, 116, 119, 159-167, 205, 217, 218, 239, 241
Inverness 45, 46, 52-53, 111, 141, 146, 162, 177-181, 218, 231
Lancaster 37, 50-51, 116, 205, 217
Leeds 37, 217
Manchester 37, 50-51, 217
Oban 45, 46, 50-51, 52-53, 116, 205, 208-215, 218, 241
Portree 45, 46, 52-53, 221-223
York 37, 50-51, 205, 217
Groups
No 7 Group, Manchester 37
No 8 Group, Leeds 37
No 9 Group, York 37, 205, 217
No 10 Group, York 37, 205, 217
No 27 Group, Oban 46, 207
No 29 Group, Lancaster 37
No 31 Group, Dunfermline/Galashiels 37, 45, 46, 48, 143-144, 145, 146, 155-159, 160
No 32 Group, Carlisle 46, 48, 129-134
No 33 Group, Ayr 46, 116-119
No 34 Group, Glasgow 46, 108, 119, 156, 159-167
No 35 Group, Oban 45, 46, 208-215
No 36 Group, Dunfermline 46, 143-147, 156, 159, 160
No 37 Group, Dundee 46, 139-142, 160
No 38 Group, Aberdeen 46, 106-111, 160
No 39 Group, Inverness 46, 177-181
No 40 Group, Portree 46, 221-223
Posts
Aberchirder 110
Aberfeldy 141
Aberfoyle 162
Aberlady 157
Aberlemno 141
Abernyte 145

Abington 162
Airdrie 162
Alexandria 163
Alford 109
Allonby 133
Alness 180
Alston 133
Alyth 141
Appin 210
Ardgay 180
Arbroath 141
Arduaine 210
Arisaig 210
Armathwaite 133
Arrochar 210
Ashkirk 158-159
Athelstaneford 157
Auchenblae 140
Auchenmalg 119
Auldgirth 118
Balerno 158
Ballantrae 119
Ballater 110
Bankfoot 145
Bannockburn 145
Bargrennan 118
Barr 119
Barrhill 119
Barrhead 163
Balintore 180
Bathgate 158
Beattock 133
Beauly 179
Beith 163
Bellingham 132
Bentpath 133
Berridale 180
Bettyhill 180
Blackford 145
Blair Atholl 141
Boddam 109
Bonchester Bridge 158
Bo'ness 158
Boreland 133
Bothwell 163
Braco 145
Braemar 109, 110
Brampton 133
Brechin 140
Bridge of Earn 145
Bridge of Gaur 141
Bridge of Orchy 210
Bridge of Weir 163
Broadford 223
Brodick 163
Brora 180
Broughton 162
Buckie 108, 109, 110
Bucksburn 109
Cabrach 110
Caldbeck 133
Callander 145
Cannich 179
Canonbie 133
Carluke 162
Carnoustie 141
Carradale 163
Carron 179
Carsphairn 119
Castle Douglas 118
Catrine 162
Cawdor 179
Chatton 159
Chirnside 157
Clachan 163
Clova 141
Clovenfords 158
Cockermouth 133
Coldstream 158
Cortachy 141
Crail 144
Creetown 118
Crianlarich 210
Crieff 145
Cromarty 180
Cruden Bay 109
Culgaith 133
Cummertrees 133
Cupar 144
Dalkeith 158

Dallas 179
Dalmally 210
Dalmellington 119
Dalry 118
Dalston 133
Dalwhinnie 179
Darvel 162
Dingwall 180
Dornoch 180
Douglas 162
Doune 145
Downfield 145
Drumadoon 163
Drummuir 110
Drumnadrochit 179, 181
Drumoak 109
Dumfries 133
Dunbar 157
Duncansby Head 180
Dunkeld 141
Dunlop 163
Dunning 145
Duns 157
Dunsyre 162
Dunure 119
Dunvegan 223
Eaglesham 163, 164
Echt 107, 109
Edzell 139, 141
Elgin 179
Elie 144
Eskdalemuir 133
Ervie 119
Eyemouth 157
Falkirk 145
Falkland 144
Farr 179
Fern 141
Feughside 109
Findhorn 179
Forfar 139, 141
Fort Augustus 179
Fort William 209, 210, 211
Forth 162
Fortrose 180
Friockheim 141
Fyvie 109
Gardenstown 110
Garelochhead 210
Garlieston 118
Garvald 157
Gatehouse of Fleet 118
Gauldry 145
Gilsland 133
Glamis 141
Glasgow 160-162, 163
Glenbarr 163
Glenbrittle 223
Glen Etive 210
Glenferness 179
Glenfinnan 210
Glenisla 141
Gordon 158
Gourock 163
Grange 110
Granton 158
Grantown on Spey 179
Grantshouse 157
Greg Ness 109
Greystoke 133
Haydon Bridge 133
Heriot 158
Humbie 158
Huntly 110
Innerwick 157
Inverallochy 109
Inveraray 210
Inverbervie 140
Inverebrie Hill 109
Inverkeilor 140
Inverkeithing 144
Inverness 179
Irvine 163
Isleornsay 223
Jedburgh 158-159
Joppa 119
Kames 163
Kelso 158
Kelty 145
Kennethmont 110

Keswick 133
Kielder 132
Kilchattan 163
Kildonan 163
Kildrummy 110
Killearn 162
Killin 145
Kilmarnock 162, 163
Kilsyth 162
Kingairloch 210
Kinghorn 144
Kingussie 179
Kinlochleven Dam 210
Kintore 109
Kippen 162
Kirkbean 133
Kirkbride 133
Kirkcowan 118
Kirkcudbright 118
Kirkgunzeon 118
Kirtlebridge 133
Laggan 210, 211
Latheronwheel 180
Lauder 158
Laurencekirk 140
Lesmahagow 162
Letham 141
Leven 144
Leslie 144
Liddesdale 132
Lilliesleaf 158
Lintrathen 141
Lochaline 210
Lochgilphead 210
Lockerbie 133
Longformacus 157
Macduff 110
Machrihanish 163
Mallaig 210
May Island 144
Meikleour 141, 145
Melvich 180
Methven 145
Milnathort 145
Milngavie 163
Minard 210
Moniaive 118
Morebattle 158
Muckhart 145
Muirkirk 162
Nairn 179
New Cumnock 119
New Deer 109
New Luce 119
New Mills 145
Newbigging 141
Newburgh (Aberdeen Group) 109
Newburgh (Dunfermline Group) 144
Newton Stewart 118
Newtyle 141
North Berwick 157
Oban 210
Onich 210
Parkgate 133
Parton 118
Peat Inn 144
Peebles 157, 158
Penicuik 158
Pitcaple 109
Port William 118
Portlethen 109
Portree 222, 223
Portsoy 110
Prestwick 119
Roadhead 132
Rockcliffe (Ayr Group) 118
Rockcliffe (Carlisle Group) 133
Rosehearty 109
Rothesay 163
St Andrews 144
St Boswells 158
St Cyrus 140
St Fergus 109
Salen 210
Sandhead 119
Sanquhar 118
Scone 145
Seil Island 210
Shotts 162
Silloth 133

Skelmorlie 163
Slamannan 162
Spean Bridge 210, 211
Steele Road 132
Stepps 163
Stonehaven 109
Stow 158
Straiton 119
Strathaven 162, 163
Strathdon 109
Strichen 109
Strontian 210
Tain 179, 180
Tarbert 210
Tarfside 141
Tarland 109
Taynuilt 210
Tayport 144
Teviotdale 158
Thankerton 162
Thornhill 118
Thornton 144
Thurso 180
Tillicoultry 145
Tranent 158
Tulloch 210
Turnberry 119
Turriff 110
Udny Station 109
Uig 223
Watten 180
Wearhead 133
West Calder 158
West Kilbride 163, 164
West Linton 158
Westruther 157
Whitebridge 179
Whitfield 133
Wick 180
Wigton 133
Winchburgh 158
Workington 133
Yarrow 158
Ruggles-Brise, Lieutenant-Colonel Sir JA 106, 168, 182

S

St Andrews (see also Royal Observer Corps Posts) 144
Sandra beacon 91
Saul, Air Vice-Marshal RE 148, 149, 248
Scalloway 194
Scheveningen 245
Scott, Major JR 230
searchlight 168, 187, 226, 240, 246
sector clock 64, 70, 71, 72
Shanghai Volunteer Corps 130
Shetland Islands 30, 44, 49, 86, 88, 91, 185, 193, 194, 226, 227, 231, 253, 265
Shute, Pat 212-213
Simpson, Colonel J 108
Sinclair, Sir Archibald 149
Skye 49, 90, 269
Somerville, Wing Commander DM 225
Staffin Bay 90
Standard Telephone and Cable Company 94
Stavanger 29
Stevens, Squadron Leader EH 235
Stewart, Lieutenant ASA 113
Stonehaven 109, 149, 219
Stornoway (see also Fighter Sector Headquarters; filter rooms; Gun Operations Rooms; Naval Plotting Rooms) 90, 96
Stromness 183, 225, 226, 249
Struthers, Major James G, DSC 208-209, 211, 214
Sudetenland 34, 36
Sutherland 49, 221

T

Tarfside (see also Royal Observer Corps Posts) 139
Tay, River 110, 143, 155, 160, 219
Taylor, Margaret 126-127
Teller 63, 71, 72, 89, 115, 116, 123, 126, 127, 131, 146, 184, 205, 214, 217, 218, 221, 223, 228, 239, 241
Tees, River 33, 143, 155, 160, 238

Thames Estuary 34
Thurso (see also Royal Observer Corps Posts) 225
Tideman, Squadron Leader 106
Tiree (see also Fighter Sector Headquarters; filter rooms, RAF miscellaneous units No 18 Wireless Observer Unit) 49, 90
Tobermory (see also RAF miscellaneous units No 18 Wireless Observer Unit Posts) 90
Tomes, Squadron Leader JM 235
Trondheim 110, 265
Truscott, Major JV 105
Turnbull, Flying Officer 219
Tye, Flight Lieutenant EHS 225
Tyne, River 216, 217, 238

V

Very High Frequency Direction Finding 78-88, 229, 233
VHF Fixer stations 50-51, 52-53, 79
Aird 85
Alderston Hill 86
Balthayock 81-82, 83, 85
Brough 80, 86
Cauldhame 79, 83, 85
Cairn Hill 80, 85
Carnbee 79
Coillabus 80, 85
Crussa Field 86, 88
Cumbernauld 86
Cumwhitton 86
Dean Moor 86
East Kirkbride 80
Eshaness 86, 88
Exnaboe 88
Fea Hill 85
Findochty 80, 83, 85, 233
Fair Isle 86
Flossy Knowes 86, 88
Gowanfield 85
Greenock 80, 86
Hawthornside 82, 83, 86
Haydon Bridge 86
Herscha Hill 80, 85
Hill of Swinister 86, 88
Hill of Warse 80
Hill Rig 80, 81, 85
Isbister 88
Kirkcolm 80
Lamberton Moor 79, 81, 86
Lettermuir 86
Largoward 79, 85
Lybster 79, 80, 85, 233
Maidens Hall 86
Melvaig 81, 85
Muncraig 86
Outhmuir 85
Panteth Hill 86
Perwinnes Moss/Corse Hill 85
Pisgah 80, 85
Portmahomack 85, 233
Rosneath 80
Scarinish 85
Scatsta 86
Scurdie Ness 80
Shebster 79, 80, 83, 85
Shoreswood 86
Skaw 86
Skipmyre 86
Straiton 79, 86
Strathy Point 79
Tullyfergus 81, 85
Upper Dysart 80, 81, 85
Warthill 79, 85
West Kilbride 80
VHF Homer stations 79
Charterhall 81
Scurdie Ness 80
Skeabrae 83
Stornoway 229
Tain 233

W

WAAF 62, 63, 71, 81-82, 83, 122, 123, 126, 129, 148, 175, 185-187, 196, 197, 198, 199, 204, 215, 219, 220, 241, 265
Walker, Squadron Leader 228
Ware, Hubert 130-132
Wee Fea (see Naval Plotting Rooms)
Western Isles 48, 49, 90, 93, 120, 211
Whalsay 86, 194
Wharrie, Major RB, MC 160
Whitfield, PH 167
Whitworth, Peter 211-212
Whyte, Major John D 226
Wigtown 116
Willder, Pilot Officer 224
Williams, Jeanne 184-187
Williamson, George A 107, 108, 111
Wilson, Flight Lieutenant 114
Wireless Observer Unit (see Royal Air Force miscellaneous units)
Wireless Telegraphy (W/T) 45, 73, 89, 96-99, 226, 248, 253, 260, 262
Wolfe, Squadron Leader 114
Worrall, Nancy 204-205
Wrigley, Wing Commander 228
WRNS 256, 264, 265
Wylie, Aileen 220
Wylie, Joan 71, 220

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IN SCOTLAND 1938-46

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